



# Statistical Summary of SEWAGE WORKS IN THE UNITED STATES

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## INTRODUCTION

This report summarizes and analyzes data on community sewage works in the United States based on the 1957 Inventory of Municipal and Industrial Wastes Facilities (1). This is the third such study prepared by the Public Health Service (2), (3).

Comprehensive data are presented by States, major drainage basins, and community size groups.

### History

The Public Health Service initiated comprehensive activities in the compilation of water and sewage statistics in 1939. Such data have been gathered since that time in varying forms. (For a more complete discussion of Inventory development see Supplement 213—Public Health Reports (3).)

Following passage of the Water Pollution Control Act of 1948 (P. L. 845, 80th Congress), the items collected concerning sewage works were expanded, and data on industrial wastes sources were added. These data were listed by drainage basins and, when analyzed, furnished base information for the development of comprehensive programs for the control of water pollution. At the same time that these data were being assembled, the Public Health Service was continuing the compilation of its Inventory of Water and Sewage Facilities in cooperation with the state health departments. Since both sewage works listings were similar, it was logical that they be combined.

Separate listings were developed; one for water supply facilities, the other for sewage and industrial wastes facilities. The data items included in the latter listing are shown in the form headings reproduced in Figure 1.

Beginning in 1952, these data were requested from the State agency responsible for water pollution control activities. While many States have produced annual revisions of the inventory beginning in 1953, the listings for the entire United States were not available until 1957.

A National Inventory of Sewage and Industrial Wastes Facilities is currently being prepared for printing, and will be available for distribution in the fall of 1958.

Reports as received from the various State agencies were edited and then embossed on metal address plates. Using normal listing equipment which extends lines of data listed vertically on the plates to a horizontal position on the forms, the inventories were printed. While plates are

## INVENTORY OF MUNICIPAL AND INDUSTRIAL WASTE FACILITIES

COMMUNITY, SEWER OR SANITARY DISTRICT INSTITUTION OR INDUSTRY	1958 POPULATION		ESTIMATED POPULATION SERVED	TYPE SEWER SYSTEM	IND. GROUP WASTE CLASS.	TREATMENT FACILITIES	Discharge to	LINE No.		
	ESTIMATED POPULATION	NUMBER OF PLANT EMPLOYEES							TREATMENT	
										TREATMENT
								1		
								2		
								3		
								4		
								29		
								30		

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Figure 1.

filed alphabetically within a State, the use of small metal tabs for coding permits the preparation of listings by drainage basins, State administrative regions, or other breakdowns depending on requirements. Corrections of reports are handled by reembossing only the items affected or by complete reembossing depending on the number of corrections.

## I. BASIC DATA

### Methods

This summary is based on the data contained in the 1957 Inventory of Sewage and Industrial Wastes Facilities; however, 1953 data were the latest available for Alabama, Michigan, and Louisiana. In preparing this summary report only those entries pertaining to municipal sewage facilities were used. All institutional and industry data were eliminated from consideration. The term "municipal" includes not only incorporated and unincorporated communities, but also sanitary districts in their many forms, and such places as mill villages where there is a permanent resident population engaged in the normal domestic pattern of living.

The basic Inventory listings were checked for omissions and irrelevancies, certain data were interpreted for coding, and all pertinent items were punched into cards. Programs were developed and the tabular material produced using modern, high-speed machine tabulating equipment. While this processing method proved superior to older, hand-tabulation procedures, the time necessary for processing due to the wide data spread and the machines' physical limitations indicated the need for programming future summaries using electronic computers.

The basic tabular data are shown in three major classifications: population groups, States, and drainage basins. In one instance, data are grouped by the standard Census Bureau geographical areas.

INVENTORY OF MUNICIPAL AND INDUSTRIAL WASTE FACILITIES

										STATE	YEAR	PAGE	
LINE No.	DRAINAGE BASIN SUB-BASIN	WATER-COURSE MILEAGE	P.E. (2000)		STREAM FLOW FOR DESIGN			DRAINAGE AREA (Sq. Miles)	POPULATION IN BASIN (Year)	DRAINAGE DISTANCE (Miles)	PRESENT FUTURE	REMARKS	ADDITIONAL COMMENTS
			UNTREATED WASTE	DISCHARGED WASTE	DESIGN FLOW (CFS)	DESIGN FLOW (MGD)	DESIGN FLOW (MGD)						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1													
2													
3													
4													
...													
29													
30													

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*Figure I—Continued.*

Ranges for the population groups used are as follows:

Group	Population Range
1.....	Under 500
2.....	500-1,000
3.....	1,000-5,000
4.....	5,000-10,000
5.....	10,000-25,000
6.....	25,000-50,000
7.....	50,000-100,000
8.....	100,000 and over

Individual entries were assigned to a particular population group on the basis of the 1950 census population of the community. For those unincorporated places where census data were not available, and where the State water pollution control agency had not furnished a "census" population, data from the 1956 Rand-McNally Commercial Atlas were used. Lacking this, the estimated population served was used as the "census" population. Sanitary and other special districts were classified in the group represented by the estimated population served where no "census" population was attributable to the entry.

The United States was divided into drainage basins by the Public Health Service following passage of the Water Pollution Control Act of 1948. With but minor modification, these same basins have been used for this report. The following is the list of the major basins:

Northeast	Missouri River
North Atlantic	Southwest—Lower Mississippi
Southeast	Colorado River
Tennessee River	Western Gulf
Ohio River	Pacific Northwest
Lake Erie	California
Upper Mississippi	Great Basin
Western Great Lakes	

Figure 2 delineates these basins on a United States map.

These basins are further broken down into 242 subbasins. Data have been tabulated by these subbasins, but are not reproduced in this report. This detailed information has been furnished to the cooperating organizations, and is on file at the Washington headquarters of the Public Health Service's Water Supply and Water Pollution Control Program.

## MAJOR RIVER BASINS OF THE UNITED STATES

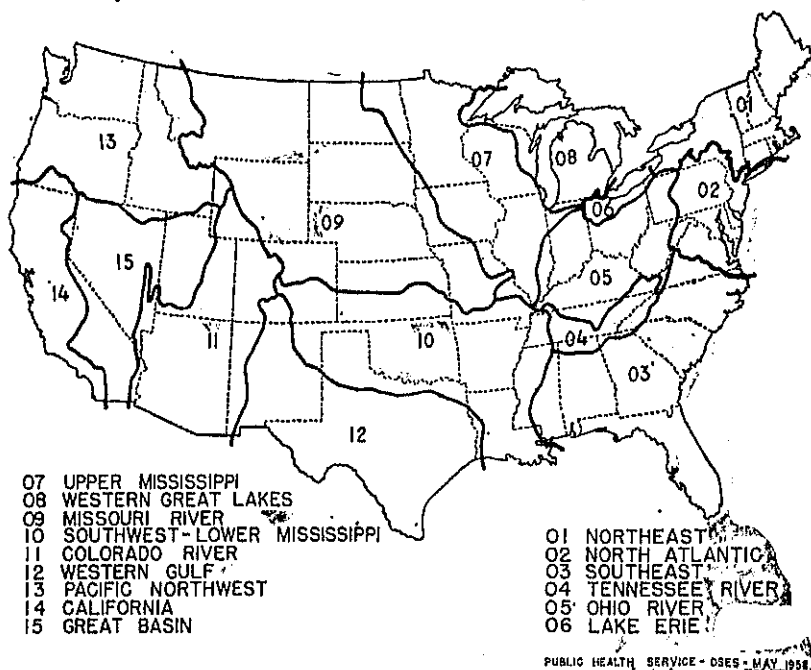


Figure 2.

Data for estimated population served were quite complete in the inventory listing. Where such data were not available, the census populations, rounded to the nearest 10, were used. These cases comprise the only instances where arbitrary procedures were used to add individual data items to the inventory. All other data items are as furnished by the reporting agency.

In the summary data none of the estimated population-served figures has been rounded off, because of inherent difficulties in adjusting several sets of comparable data simultaneously. No fictitious precision is imputed to these data, however, since they are, at best, only estimates.

## Summary Data

The basic data produced in this summary are presented in nine tables. National summaries are given in tables 1, 2, and 3 for sewer systems,

sewage disposal and treatment. Detailed data by States, population groups, and major drainage basins are presented in tables 5 through 9, inclusive.

The data in tables 1, 2, and 3 represent a portion of the data appearing in the total columns of the detailed tables. They are presented as separate items for clarity and comparison, and for a quick summary of nationwide conditions.

Both tables 2 and 3 present additive data, as do the corresponding detailed tables (6 and 7). Where more than one type of settling tank was present in a primary plant, the plant was classified in an "other" category. In secondary treatment plants, two or more secondary processes are often present. Rather than present only unit process data which are not additive, secondary plants were arbitrarily assigned to a process on the following basis for table 7. Land application, oxidation ponds, and sand filters were considered subsidiary to either activated sludge or trickling filter processes. As a consequence, where any of these processes followed an activated sludge process or a trickling filter, they were not counted in this table. Both land application and oxidation ponds were considered subsidiary to sand filters. In a very few instances, both trickling filters and the activated sludge process appeared in the same plant. These cases were individually examined and assigned on the basis of professional judgment.

Table 1. *General and treatment summary for the United States*

	Number	Percent
Number of communities		
—with sewer systems	11,131	.....
—discharging raw sewage only	3,065	27.5
—discharging treated sewage only	7,966	71.6
—discharging both raw and treated sewage	100	0.9
Type sewers—number of communities:		
Separate	8,632	82.1
Combined	1,451	13.0
Both	428	4.1
Not stated	620	.....
Census population of seweried communities	102,047,712	.....
Estimated population:		
Connected to sewers	98,361,396	
Discharging raw	21,917,665	22.3
Discharging treated	76,443,731	77.7
TREATMENT		
Treatment plants—total	7,518	100.0
Minor <sup>1</sup>	41	0.6
Primary	2,730	36.3
Intermediate	100	1.3
Secondary	4,647	61.8
Estimated population served by:		
Minor Treatment <sup>2</sup>	1,860,330	2.4
Primary Treatment	25,666,745	33.6
Intermediate Treatment	5,590,952	7.3
Secondary Treatment	43,325,704	56.7

<sup>1</sup> Percent of reported cases, not percent of total communities.

<sup>2</sup> Less than sedimentation.



Table 2. *Primary treatment plant summary for the United States*

Process	Number of plants	Estimated population served	Percent of	
			Number of plants	Estimated population served
Septic tanks.....	780	986,561	28.6	3.8
Imhoff tanks.....	1,084	3,346,062	39.7	13.0
Mechanically cleaned tanks.....	656	18,646,416	24.0	72.7
Plain, hopper bottom tanks.....	80	1,344,385	2.9	5.2
Settling tanks—No detail in inventory.....	53	1,019,261	2.0	4.0
Others and Unknown.....	77	324,060	2.8	1.3
Total.....	2,730	25,666,745	100.0	100.0

Table 3. *Secondary treatment for the United States*

Process	Number of plants	Estimated population served	Percent of	
			Number of plants	Estimated population served
Activated sludge.....	589	24,753,730	12.7	57.1
Trickling filter: Standard rate.....	1,870	9,351,062	40.2	21.6
High rate.....	812	5,962,844	17.5	13.8
Sand filters.....	394	830,198	8.5	1.9
Land application.....	340	996,392	7.3	2.3
Oxidation ponds.....	430	759,941	9.2	1.8
Others and Unknown.....	212	671,537	4.6	1.5
Total.....	4,647	43,325,704	100.0	100.0

Table 4. *Population connected to sewers and served by disposal facilities—by population groups*

[Estimated Population]

Population size groups	Served by sewage disposal <sup>1</sup> facilities	Connected to sewers	Served by sewage disposal <sup>1</sup> facilities of other communities or sanitary districts	Contributed by other communities for disposal
Under 500.....	368,086	421,226	54,010	870
500-1,000.....	1,207,421	1,288,961	88,740	7,200
1,000-5,000.....	9,590,763	10,681,868	1,275,033	183,928
5,000-10,000.....	7,266,284	8,437,838	1,375,455	203,991
10,000-25,000.....	11,128,680	13,695,429	3,139,508	572,759
25,000-50,000.....	8,044,376	10,276,364	2,842,312	610,324
50,000-100,000.....	8,446,722	9,570,393	2,406,466	1,282,795
Over 100,000.....	52,309,064	43,989,317	8,959,054	17,278,601
Total.....	98,361,396	98,361,396	20,140,578	20,140,578

<sup>1</sup> "Sewage Disposal"—The act of disposing of sewage by any method. The term is not synonymous with "Sewage Treatment." Glossary Water and Sewage Control Engineering, American Society of Civil Engineers, 1949.

Data for certain selected processes used in intermediate and secondary treatment plants are presented in table 8. These data are not additive, and both plants and populations have been counted under multiple headings where two or more processes are present in the same plant.

The data reported in table 9 for sludge processing are not additive. Where several processes occurred in one plant, the plant was counted under the various headings. Since it is not possible to distribute the population served among the various processes used in a single plant, such data are not included.

Table 4 presents population served data by the various population groupings, in order to relate them properly to the census population of the communities within each population group. Normal data processing techniques count communities and census populations within the proper group. However, if the sewage is disposed of through another community or a sanitary district, the population served is counted for the group in which the other community or sanitary district falls. Without special treatment of the data, comparisons are not adequate. Column 3 of this table shows the population connected to sewers within the communities of the particular group, while column 2 shows the population which is served by disposal facilities of communities in that group or by special districts classified in that group. Columns 4 and 5 show the population interchange when sewage is disposed of through nonlocal facilities.

Table 5. *Summary of sewer systems and sewage disposal by population groups, States and drainage basins*

POPULATION SIZE GROUPS	Num-ber of com-mu-nities	1950 census population	Estimated population connected to sewers	Type of sewer system			Raw sewage disposal		Treated sewage disposal		Both raw and treated sewage disposal		
				Separate	Com-bined	Both	Num-ber of com-mu-nities	Estimated population served	Num-ber of com-mu-nities	Estimated population served	Num-ber of com-mu-nities	Estimated population served	
STATES													
Under 500.....	1,254	375,495	368,086	1,032	73	7	319	93,109	930	270,617	5	4,360	
500-1,000.....	1,866	1,430,092	1,207,421	1,365	225	24	563	347,625	1,300	854,135	7	5,661	
1,000-5,000.....	5,211	12,911,091	9,590,763	4,164	652	143	1,536	2,736,545	3,638	6,774,414	37	79,894	
5,000-10,000.....	1,267	8,741,686	7,266,284	912	199	79	328	1,683,245	926	5,507,384	13	75,655	
10,000-25,000.....	889	13,517,378	11,128,680	632	148	85	285	2,586,930	672	8,321,220	12	220,530	
25,000-50,000.....	299	10,204,658	8,044,376	178	70	44	265	1,970,307	225	5,776,939	9	297,130	
50,000-100,000.....	134	9,440,613	8,446,722	67	46	20	30	2,081,090	101	6,092,632	3	273,000	
Over 100,000.....	117	45,391,099	52,309,064	52	38	24	19	5,206,448	84	35,318,116	14	11,784,500	
STATES													
Alabama.....	176	1,350,133	1,063,050	171	.....	.....	74	408,065	96	512,335	6	136,650	
Arizona.....	93	385,339	499,562	91	1	.....	7	21,850	86	47,712	.....	.....	
Arkansas.....	140	741,180	607,725	134	2	.....	31	242,840	108	358,885	1	6,000	
California.....	651	9,753,763	10,492,872	629	11	2	38	218,483	610	9,393,089	3	881,300	
Colorado.....	164	936,264	1,072,945	141	4	1	39	63,394	124	1,007,851	1	1,700	
Connecticut.....	75	1,453,392	1,305,260	35	16	10	16	64,400	54	1,173,860	5	67,000	
Delaware.....	53	192,756	184,220	19	5	.....	10	14,650	43	1,169,570	.....	.....	
District of Columbia.....	1	802,178	1,240,000	.....	.....	1	.....	.....	1	1,240,000	.....	.....	
Florida.....	215	1,675,448	1,524,489	144	2	.....	36	381,395	178	1,116,094	1	57,000	
Georgia.....	216	1,579,659	1,322,280	197	1	4	65	444,550	147	782,830	4	94,900	
Idaho.....	98	289,827	259,265	81	12	.....	46	137,895	52	121,370	.....	.....	
Illinois.....	519	7,760,337	7,490,946	329	161	19	53	373,125	465	7,115,041	1	2,780	
Indiana.....	289	2,416,912	2,368,040	488	197	2	153	388,938	136	1,979,102	.....	.....	
Iowa.....	395	1,533,376	1,317,740	337	19	9	78	372,850	316	943,080	1	1,810	
Kansas.....	287	1,173,131	1,194,355	217	1	3	37	228,820	249	886,535	1	79,000	
Kentucky.....	142	1,008,766	1,004,645	109	27	5	51	97,875	89	874,370	2	32,400	
Louisiana.....	105	1,451,092	1,285,937	99	29	.....	36	938,423	69	347,534	.....	.....	
Maine.....	134	599,737	509,277	99	57	11	115	394,931	10	50,295	9	64,051	
Maryland.....	120	1,491,676	1,440,920	103	8	3	23	45,810	97	1,095,120	.....	.....	
Massachusetts.....	164	4,162,114	3,641,240	91	36	35	55	602,950	107	2,425,290	2	613,000	
Michigan.....	349	4,456,232	4,356,127	128	143	33	175	620,680	172	3,734,332	2	915	
Minnesota.....	400	1,903,548	1,583,910	351	43	2	95	122,036	305	1,461,874	.....	.....	
Mississippi.....	198	692,493	383,660	127	.....	.....	32	392,930	76	190,730	.....	.....	
Missouri.....	312	2,544,660	2,160,301	253	8	22	103	1,530,786	207	577,225	2	32,290	
Montana.....	112	335,399	331,155	104	5	.....	30	172,720	80	148,885	2	9,350	

Nebraska.....	253	794,337	724,622	235	13	5	88	195,375	164	289,247	1	240,000
Nevada.....	40	126,928	179,960	36	4	.....	7	9,116	33	170,844	.....	.....
New Hampshire.....	69	375,066	279,300	42	11	.....	55	226,900	14	32,400	.....	.....
New Jersey.....	282	4,108,568	4,028,148	247	17	1	8	74,140	272	3,881,708	2	72,300
New Mexico.....	65	367,875	4,495,385	65	.....	.....	1	1,000	64	494,365	.....	.....
New York.....	502	12,542,667	12,487,854	405	41	30	150	807,954	349	3,447,200	10	8,232,700
North Carolina.....	308	1,542,470	1,536,825	307	.....	.....	75	49,760	207	1,048,010	6	49,655
North Dakota.....	137	281,049	263,000	81	48	.....	19	58,350	118	4,208,650	.....	.....
Ohio.....	513	5,738,799	5,875,328	273	127	52	149	582,811	321	4,659,732	5	632,785
Oklahoma.....	243	1,293,418	1,162,033	241	.....	.....	11	51,390	232	1,110,643	.....	.....
Oregon.....	142	840,794	830,180	99	34	7	24	47,100	117	399,080	1	384,000
Pennsylvania.....	908	8,228,877	7,572,533	562	109	70	524	3,087,332	372	4,245,741	10	39,460
Rhode Island.....	28	645,077	541,590	120	6	2	8	3,930	20	237,640	.....	.....
South Carolina.....	161	805,356	724,835	157	.....	.....	38	291,045	121	420,450	2	11,350
South Dakota.....	158	318,267	312,735	125	21	12	31	43,235	126	262,900	1	6,600
Tennessee.....	126	1,488,971	1,485,602	118	3	.....	41	644,679	83	674,723	2	166,200
Texas.....	664	5,200,795	5,041,670	680	1	.....	14	100,750	650	4,400,920	.....	.....
Utah.....	43	489,964	503,291	31	1	.....	37	290,435	58	203,886	.....	.....
Vermont.....	78	121,666	161,545	81	46	.....	70	126,245	8	35,300	.....	.....
Virginia.....	163	1,257,475	1,241,829	146	2	.....	57	426,670	103	782,514	3	38,645
Washington.....	207	1,509,663	1,550,692	131	47	17	49	304,415	151	509,287	7	736,990
West Virginia.....	164	226,436	627,893	100	44	13	132	404,173	27	110,549	5	72,871
Wisconsin.....	428	2,271,729	2,208,124	331	50	45	32	85,130	407	2,121,956	1	1,988
Wyoming.....	67	181,353	188,731	39	.....	.....	27	64,988	39	117,793	1	5,950
MAJOR DRAINAGE BASINS												
Northeast.....	888	10,739,078	9,740,722	523	204	79	439	2,037,901	426	6,652,070	23	1,050,751
North Atlantic.....	1,211	22,134,500	21,644,102	883	122	.....	345	1,843,905	858	11,762,248	8	8,037,950
South Atlantic.....	1,108	7,373,430	6,495,399	1,010	3	4	302	2,296,435	789	4,071,269	17	297,695
Tennessee River.....	143	932,710	1,033,999	133	2	.....	62	198,859	76	545,385	5	189,755
Ohio River.....	1,357	9,940,542	9,498,465	802	365	111	705	3,449,790	635	5,282,444	17	766,231
Lake Erie.....	217	2,838,634	2,930,472	96	77	.....	65	138,748	148	2,783,739	4	7,985
Upper Mississippi.....	1,548	12,985,290	11,917,719	1,167	271	64	271	1,745,258	1,274	10,164,923	3	7,558
Western Great Lakes.....	571	6,412,700	6,272,328	283	195	30	194	680,136	375	5,591,277	2	915
Missouri River.....	1,129	4,194,988	4,031,638	984	70	50	269	1,306,626	853	2,358,797	7	366,220
Southwest-Lower Mississippi.....	934	5,732,222	5,266,403	914	5	.....	166	1,829,111	767	3,431,292	1	6,000
Colorado River.....	189	580,514	740,915	182	3	1	29	46,561	159	690,054	1	4,300
Western Gulf.....	624	5,076,721	4,979,320	612	2	.....	17	108,655	607	4,870,665	.....	.....
Pacific Northwest.....	464	2,767,604	2,782,850	323	96	24	131	571,810	324	1,087,060	9	1,123,980
California.....	609	9,633,044	10,338,221	587	11	5	34	187,955	573	9,291,836	2	878,430
Great Basin.....	189	635,735	668,842	183	.....	.....	36	333,574	102	332,398	1	2,870
Total.....	11,131	102,047,712	98,361,396	8,632	1,431	428	3,065	16,705,299	7,966	68,915,457	100	12,740,640

Table 5. Summary of sewer systems and sewage disposal by population groups, States and drainage basins—Continued

	Sewage treatment plants									
	Raw sewage disposal		Treated sewage disposal		Minor		Primary		Intermediate	
	Number of systems	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served
POPULATION SIZE GROUPS										
Under 500.....	294	93,914	808	274,172	1	400	317	98,738	490	175,044
500-1,000.....	552	352,259	1,322	855,201	4	2,790	550	340,973	764	506,882
1,000-5,000.....	1,357	2,788,116	3,468	6,802,647	15	27,940	1,307	2,189,222	2,126	4,533,565
5,000-10,000.....	1,315	1,732,910	3,803	5,533,374	3	28,050	242	1,602,816	597	3,693,534
10,000-25,000.....	210	2,712,660	595	8,416,020	6	766,400	156	1,906,612	413	5,325,713
25,000-50,000.....	74	2,091,107	199	5,953,269	1	30,000	71	359,387	110	3,205,087
50,000-100,000.....	38	2,144,290	99	6,302,432	6	454,160	21	1,524,341	62	3,978,730
Over 100,000.....	33	10,002,443	164	42,306,616	5	550,500	62	15,754,237	35	21,907,149
STATES										
Alabama.....	98	509,590	120	553,460			94	435,150	1	30,000
Arizona.....	7	21,850	82	477,712			23	39,625	3	42,500
Arkansas.....	32	246,840	119	360,885			80	165,485	2	3,200
California.....	41	241,463	450	10,251,409	3	124,500	119	5,929,213	4	276,200
Colorado.....	40	63,594	108	1,009,351			50	90,872	4	635,987
Connecticut.....	21	101,400	66	1,203,860	2	16,000	41	944,645	2	96,360
Delaware.....	10	14,650	9	169,570	1	50	7	167,770		1,750
District of Columbia.....			1	1,240,000				1,240,000		
Florida.....	35	394,895	183	1,229,394	1	30,000	81	451,260	1	35,000
Georgia.....	68	521,850	165	800,430			108	195,980	1	204,000
Idaho.....	46	137,895	52	121,370	1	400	30	22,020	1	3,200
Illinois.....	48	373,903	381	7,173,041			72	522,640	3	72,850
Indiana.....	154	383,038	138	1,979,102			32	235,365	1	6,000
Iowa.....	79	372,950	332	944,702			37	90,447	1	3,500
Kansas.....	36	242,020	250	952,335			37	336,145		
Kentucky.....	53	126,525	84	378,120			25	451,890	3	147,680
Louisiana.....	35	932,423	72	347,334			19	41,012		
Maine.....	149	453,406	70	1,555,016	1	500	15	53,700		
Maryland.....	23	45,810	52	1,095,120	3	5,580	31	203,163	4	1,476
Massachusetts.....	58	1,064,130	68	2,577,110	3	998,100	13	1,027,090	18	886,377
Michigan.....	175	621,295	144	3,734,332	1	1,630	82	2,836,425	47	552,010
Minnesota.....	95	122,036	279	1,461,874			101	138,400	6	120,369
Mississippi.....	52	392,930	79	1,190,730			52	86,750	2	900,000

Missouri.....	71	1,576,286	236	584,015	.....	.....	.....	.....	46,275	1	1,200	196	536,540
Montana.....	28	182,120	82	149,035	.....	.....	.....	.....	83,135	3	21,500	41	39,400
Nebraska.....	90	375,375	164	349,247	1	610	.....	.....	41,170	3	2,150	126	305,317
Nevada.....	7	9,116	32	170,844	.....	.....	.....	.....	8,830	.....	.....	26	162,014
New Hampshire.....	55	226,900	15	52,400	.....	.....	.....	.....	49,300	.....	.....	5	3,100
New Jersey.....	10	94,340	224	3,933,808	1	760	.....	.....	2,623,893	7	198,200	135	1,110,953
New Mexico.....	1	1,000	69	494,385	.....	.....	.....	.....	16,785	.....	.....	62	477,600
New York.....	154	3,653,354	308	8,834,500	7	624,500	.....	.....	2,453,735	5	535,615	97	5,215,650
North Carolina.....	101	463,315	279	1,073,510	3	8,600	.....	.....	220,079	1	2,550	114	842,301
North Dakota.....	19	53,350	116	209,650	.....	.....	.....	.....	60,960	.....	.....	67	143,390
Ohio.....	134	1,044,096	297	4,831,232	.....	.....	.....	.....	852,763	20	492,815	186	3,484,624
Oklahoma.....	11	51,390	246	1,110,643	.....	.....	.....	.....	55,505	2	27,600	199	1,027,538
Oregon.....	25	67,100	117	763,080	.....	.....	.....	.....	570,150	.....	.....	66	192,930
Pennsylvania.....	448	3,093,567	290	4,278,966	.....	.....	.....	.....	549,955	7	1,447,456	161	2,232,255
Rhode Island.....	8	3,930	16	537,660	.....	.....	.....	.....	157,710	.....	.....	57	379,950
South Carolina.....	52	298,015	167	424,820	3	5,900	.....	.....	170,970	.....	.....	8	248,650
South Dakota.....	32	47,935	127	264,800	.....	.....	.....	.....	32,770	.....	.....	45	232,030
Tennessee.....	43	804,779	88	680,823	.....	.....	.....	.....	211,153	.....	.....	39	469,670
Texas.....	13	100,550	659	4,949,320	.....	.....	.....	.....	169,323	.....	.....	57	4,771,395
Utah.....	16	299,545	58	208,866	.....	.....	.....	.....	46,402	.....	.....	25	157,484
Vermont.....	71	126,545	38	33,860	.....	.....	.....	.....	33,300	.....	.....	.....	.....
Virginia.....	60	426,550	94	815,479	3	25,900	.....	.....	509,479	.....	.....	50	280,100
Washington.....	53	893,805	155	656,887	2	17,300	.....	.....	390,275	2	10,500	79	238,812
West Virginia.....	139	472,539	29	153,254	.....	.....	.....	.....	101,490	.....	.....	12	53,764
Wisconsin.....	21	86,275	353	2,121,839	.....	.....	.....	.....	415,869	12	255,690	207	1,450,350
Wyoming.....	29	67,938	40	120,793	.....	.....	.....	.....	23,380	2	18,800	22	48,613
MAJOR DRAINAGE BASINS													
Northeast.....	485	2,660,851	392	7,079,871	12	1,119,600	.....	.....	4,194,970	5	156,975	143	1,608,326
North Atlantic.....	443	4,650,945	631	16,793,198	13	539,540	.....	.....	3,522,885	14	2,993,156	243	8,376,617
South Atlantic.....	349	2,911,415	935	4,763,864	8	56,750	.....	.....	1,905,099	4	271,550	354	5,354,611
Tennessee River.....	64	477,489	85	1,536,510	.....	.....	.....	.....	302,623	.....	.....	32	353,685
Ohio River.....	626	3,963,741	599	5,534,724	.....	.....	.....	.....	1,367,718	20	611,650	365	3,535,350
Lake Erie.....	67	146,433	110	2,784,539	.....	.....	.....	.....	596,015	6	62,375	73	2,124,749
Upper Mississippi.....	232	1,752,398	1,156	1,163,321	.....	.....	.....	.....	977,279	7	872,745	863	8,375,300
Missouri River.....	193	680,920	297	1,563,321	1	1,650	.....	.....	3,081,675	18	480,834	146	8,083,913
Southwest-Lower Mississippi.....	276	1,533,771	867	2,497,787	1	610	.....	.....	681,965	5	81,827	615	1,551,044
Colorado River.....	168	1,833,111	799	3,433,292	.....	.....	.....	.....	650,906	5	81,827	554	2,097,559
Western Gulf.....	31	49,361	154	691,554	.....	.....	.....	.....	95,523	4	46,860	87	549,171
Pacific Northwest.....	17	108,655	638	4,870,665	.....	.....	.....	.....	151,320	.....	.....	527	4,718,735
California.....	133	1,183,909	529	1,598,950	3	17,700	.....	.....	983,935	3	21,500	167	570,755
Great Basin.....	36	208,485	412	1,014,736	3	124,500	.....	.....	5,920,228	4	276,200	290	3,828,208
.....	28	336,024	104	532,818	.....	.....	.....	.....	48,137	2	7,000	75	277,681
Total.....	3,048	21,917,665	7,518	76,443,731	41	1,850,330	.....	.....	25,666,745	100	5,590,952	4,647	43,325,704

Table 6. Summary of primary treatment plants by population groups, States and drainage basins

	Total		Septic tanks		Imhoff tanks		Mechanically cleaned tanks		Plain, hopper bottom tanks		Tanks with no details in listing		Others and unknown	
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served
POPULATION SIZE GROUPS														
Under 500.....	317	98,728	153	39,564	135	49,777	15	5,925	9	2,294	2	893	3	275
500-1,000.....	550	340,973	187	100,573	266	166,540	56	45,515	34	18,235	5	3,670	14	9,120
1,000-5,000.....	1,307	2,189,222	383	537,750	575	856,540	221	612,815	25	58,656	28	56,688	35	66,770
5,000-10,000.....	242	1,602,816	38	149,674	59	250,802	121	1,046,490	4	24,500	6	51,830	14	79,520
10,000-25,000.....	156	1,996,612	15	99,250	22	266,550	106	1,479,737	4	51,900	4	57,500	5	41,575
25,000-50,000.....	71	2,159,357	2	53,300	10	233,480	50	1,683,027	1	10,200	3	74,530	5	95,800
50,000-100,000.....	25	1,324,790			6	405,320	16	1,002,740	1	62,600	2	54,130		
Over 100,000.....	62	15,754,247	2	6,450	11	1,116,530	43	12,770,167	2	1,110,000	3	720,000	1	31,000
STATES														
Alabama.....	94	435,150	50	46,355	28	30,295	15	354,500					1	4,000
Arizona.....	23	39,625	11	22,985	7	21,240	1	4,000						
Arkansas.....	80	165,485	13	21,935	23	32,470	29	95,330	15	16,600				
California.....	119	5,929,213	44	38,152	13	16,469	51	5,174,617						
Colorado.....	50	90,872	18	18,193	15	13,509	14	51,920	1	1,250	1	667,450	6	32,325
Connecticut.....	41	944,645	10	16,350	3	38,200	16	738,700	4	21,770	4	115,750	4	13,875
Delaware.....	7	167,770	1	800		3,230	7	137,000	2	6,740				
District of Columbia.....	1	1,240,000						1,240,000						
Florida.....	81	451,260	34	62,980	11	7,810	32	316,420						
Georgia.....	108	195,980	32	35,680	50	52,450	21	73,400	2	5,400	1	50,000	1	8,650
Idaho.....	30	22,020	22	11,970	5	5,000	3	5,050					4	33,650
Illinois.....	72	522,640	14	30,590	29	69,710	25	415,618	4	5,730				
Indiana.....	32	285,365	5	9,520	9	13,000	18	262,845						
Iowa.....	37	90,447	27	16,667	9	3,780	1	70,000						
Kansas.....	37	336,145	3	3,530	23	30,415	9	299,900					2	2,300
Kentucky.....	25	451,890	11	20,420	9	31,890	3	397,870						
Louisiana.....	19	41,042	9	12,600	7	15,742	1	10,000	1	2,200	1	1,710	1	500
Maine.....	15	53,700	11	44,760	3	8,340							1	600
Maryland.....	31	203,163	4	1,085	19	20,078	6	167,500	2	14,500				
Massachusetts.....	13	1,027,000			1	320	12	1,026,680						
Michigan.....	82	2,836,425	22	31,595	16	307,670	37	2,412,990	4	7,370	2	51,000	1	25,800
Minnesota.....	101	138,400	3	3,920	77	60,406	16	70,085					1	3,000
Mississippi.....	52	86,750	38	44,350	10	20,200	4	19,200					2	3,000
Missouri.....	39	46,275	14	4,460	19	19,615	5	22,100	1	100				
Montana.....	38	88,135	23	22,855	8	7,080	4	54,050	1	2,800	1	1,300	1	50

[illegible]



Table 7. Summary of secondary treatment plants by population groups, States and drainage basins

	Total secondary treatment		Activated sludge		Trickling filter standard rate		Trickling filter high rate		Intermittent sand filter		Application to land		Oxidation ponds		Others and unknown	
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served
POPULATION SIZE GROUPS																
Under 500.....	490	175,044	26	9,859	131	46,057	42	39,466	89	20,193	76	17,916	101	34,413	25	7,150
500-1,000.....	764	506,882	53	36,831	317	212,492	106	79,430	105	60,370	56	31,528	101	71,926	26	14,305
1,000-5,000.....	2,126	4,533,565	213	481,576	913	1,893,378	364	935,365	154	29,129	168	354,793	197	348,111	117	267,152
5,000-10,000.....	597	3,693,534	80	561,373	271	1,596,565	146	1,016,090	25	119,465	27	148,670	23	131,991	25	119,380
10,000-25,000.....	413	5,325,713	95	1,342,240	165	1,860,152	108	1,529,636	17	227,890	7	124,485	4	48,000	17	193,319
25,000-50,000.....	110	3,205,087	40	1,272,135	31	728,395	30	914,507	2	37,800	4	175,000	2	76,500	1	750
50,000-100,000.....	62	3,978,730	30	1,855,730	18	1,182,860	9	615,350	2	111,300	2	144,000	2	49,000	1	69,490
Over 100,000.....	85	21,907,149	52	19,193,986	24	1,831,163	7	833,000								
STATES																
Alabama.....	25	88,310			16	42,690	6	44,100	1	1,000	2	520				
Arizona.....	56	395,507	2	254,000	7	40,500	1	11,500	4	25,300	17	10,379	27	53,908		
Arkansas.....	37	192,260			5	42,050	28	148,400	2	1,750						
California.....	324	3,921,496	19	2,369,075	56	348,237	51	442,146			134	489,968	53	293,651	11	68,419
Colorado.....	54	282,492			13	47,795	16	156,912			9	58,710	16	19,075		
Connecticut.....	21	146,855	2	7,250	4	13,200	1	25,000	12	81,230	1	175			1	20,000
Delaware.....	1	1,750			1	1,750										
District of Columbia.....	105	613,334	12	278,800	2	15,500	67	294,155	18	11,479	2	6,000	4	7,400		
Florida.....	56	400,450			49	369,000	4	20,950	1	1,000					2	9,500
Georgia.....																
Idaho.....	20	95,750	2	29,000	4	25,500	10	38,800	4	32,755	3	850	1	1,600		
Illinois.....	306	6,519,551	72	5,512,105	160	566,541	38	390,965	22	32,755			13	14,815	1	2,370
Indiana.....	105	1,687,737	49	1,398,565	37	171,720	17	117,302	2	35,800	84	65,365	2	400	1	500
Iowa.....	294	850,843	2	22,000	190	726,778	15	58,000	24	22,820			9	9,995	3	2,070
Kansas.....	213	616,190	9	108,400	165	414,905	3	58,000								
Kentucky.....																
Louisiana.....	56	278,550	3	15,860	35	185,865	18	76,825	1	250						
Maine.....	53	306,492	10	136,500	36	127,062	6	42,680	1	120	1	16			2	1,340
Massachusetts.....	4	1,476			10	23,887	4	25,590	1	100						
Maryland.....	18	886,377	3	831,500	11	83,350	7	246,200	27	200,360	1	100				
Michigan.....	47	552,010	1	22,000	10	23,887	4	25,590								
Minnesota.....	55	776,388	20	412,110	18	301,373	2	13,910	12	41,220	2	6,210			1	1,565
Mississippi.....	176	423,474	8	12,890	76	161,054	86	240,335	2	2,900			4	6,295		
Missouri.....	27	103,980	4	31,100	6	33,000	10	31,430	3	2,950			4	5,500		
Montana.....	196	536,540	26	104,661	124	314,304	7	16,450	21	10,830	1	1,000	16	19,805	1	69,490
Nebraska.....	41	39,400	5	5,300	1	3,000			4	5,130	3	3,460	22	22,360	1	150

Nabesaka.....	126	395,317	40	109,265	57	167,526	2	14,000	8	5,330	2	2,080	17	7,116	.....
Nevada.....	25	162,014	1	109,225	2	1,250	1	129,700	.....	.....	10	12,049	8	18,790	.....
New Hampshire.....	135	3,109	18	393,535	57	423,053	6	45,219	25	143,390	8	8,150	.....	31	97,608
New Jersey.....	67	1,110,955	.....	.....	16	63,850	23	371,940	.....	.....	.....	.....	13	15,610	2
New Mexico.....	92	471,600	.....	.....	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	2
New York.....	6	5,215,680	15	4,692,000	47	353,180	6	79,800	21	66,370	2	1,150	.....	.....	6
North Carolina.....	114	432,301	13	324,240	40	382,115	17	100,942	39	29,934	1	1,600	2	1,370	2
North Dakota.....	57	145,300	1	6,100	11	79,600	1	8,000	.....	.....	11	8,500	43	41,190	2
Ohio.....	158	3,437,624	74	2,740,664	67	582,520	18	115,745	25	40,785	.....	.....	26	73,691	1
Oklahoma.....	199	1,021,538	12	197,320	139	435,142	19	313,480	2	2,705	.....	.....	.....	.....	5,000
Oregon.....	66	122,930	6	11,230	21	66,400	30	107,400	3	600	3	4,900	3	2,400	.....
Pennsylvania.....	161	2,282,235	36	1,441,405	63	573,030	22	131,200	4	10,900	4	1,400	1	900	31
Rhode Island.....	8	379,950	4	359,300	2	19,430	.....	.....	1	800	.....	.....	.....	.....	110,420
South Carolina.....	45	248,630	7	10,400	24	126,250	11	101,000	.....	800	.....	.....	1	1,200	.....
South Dakota.....	79	232,030	3	62,750	40	120,750	3	17,800	3	2,700	1	1,300	29	26,730	.....
Tennessee.....	39	469,670	9	110,950	21	327,240	6	20,980	1	500	.....	329,345	95	176,290	2
Texas.....	57	4,771,395	42	1,477,190	99	1,152,600	122	1,402,405	6	5,130	78	3,386	2	228,345	.....
Utah.....	25	157,464	.....	.....	7	62,190	12	91,108	.....	.....	.....	.....	.....	.....	8,400
Vermont.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	100	.....	.....	.....
Virginia.....	50	280,100	8	181,320	29	58,500	6	31,430	1	300	.....	.....	.....	.....	.....
Washington.....	79	238,812	6	36,970	4	30,360	48	150,565	1	300	16	16,495	4	4,122	.....
West Virginia.....	12	531,734	1	14,000	5	38,600	.....	.....	.....	.....	6	1,164	.....	.....	.....
Wisconsin.....	207	1,450,330	44	1,021,550	92	169,735	54	241,950	8	12,395	5	2,285	4	2,415	.....
Wyoming.....	22	78,613	.....	.....	4	51,300	.....	.....	2	500	3	3,200	12	22,513	1
MAJOR DRAINAGE BASINS															
Northeast.....	143	1,603,326	10	438,050	57	442,665	11	317,180	54	330,600	4	441	1	400	28,990
North Atlantic.....	343	8,337,617	65	7,173,780	137	1,004,375	35	254,999	37	172,490	5	10,050	1	900	63
Southeast.....	364	2,350,605	37	721,940	137	949,155	110	581,277	61	44,513	5	8,120	9	13,300	5
Tennessee River.....	32	353,685	6	67,950	18	278,135	4	6,080	3	950	.....	.....	1	570	.....
Ohio River.....	365	3,535,356	94	1,977,540	165	1,095,200	60	402,912	27	33,565	9	2,164	1	900	22,975
Lake Erie.....	73	2,124,749	40	1,997,534	20	83,395	6	31,500	6	10,780	.....	.....	.....	.....	1,540
Upper Mississippi.....	863	8,315,530	116	6,028,520	449	1,509,291	161	647,132	88	82,327	10	5,685	38	39,975	1
Western Great Lakes.....	149	2,026,913	47	1,398,520	55	402,218	27	171,905	15	46,075	3	6,310	1	320	1
Missouri River.....	615	1,551,044	66	316,236	301	794,200	27	234,823	69	58,443	23	18,040	123	125,432	6
Southwest-Lower Mississippi.....	554	2,697,559	29	497,820	338	1,157,661	82	737,722	21	19,425	21	78,395	55	121,176	8
Colorado River.....	87	549,171	3	254,225	9	53,290	11	132,300	4	25,300	22	15,424	38	68,632	.....
Western Gulf.....	527	4,718,735	42	1,382,690	93	1,049,395	126	1,568,395	5	4,730	69	327,615	91	163,400	101
Pacific Northwest.....	167	570,755	15	79,850	28	119,460	98	338,065	4	900	21	21,945	11	10,535	.....
California.....	290	3,828,208	19	2,369,075	53	353,440	50	433,510	.....	.....	14	443,118	13	11,666	9
Great Basin.....	75	277,681	.....	.....	10	77,247	14	105,644	.....	.....	54	59,085	15	22,705	2
Total.....	4,647	43,325,704	589	24,753,730	1,870	9,351,062	812	5,962,844	394	830,198	340	996,392	430	759,941	212
															671,537

Table 8. Summary of selected intermediate and secondary treatment processes by population groups, States and drainage basins

	Chemical treatment		Activated sludge		Trickling filter standard rate		Trickling filter high rate		Intermittent sand filter		Application to land		Oxidation ponds	
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served
<b>POPULATION SIZE GROUPS</b>														
Under 500.....	8	8,000	26	9,859	135	47,147	43	39,766	89	20,183	87	21,531	114	38,500
500-1,000.....	53	30,511	320	214,382	320	214,382	110	81,620	105	60,370	70	41,144	127	87,746
1,000-5,000.....	76	202,275	216	490,423	285	2,002,642	378	959,640	156	258,230	217	503,158	304	582,878
5,000-10,000.....	60	459,172	83	584,573	285	1,676,065	159	1,068,228	25	119,465	45	264,670	52	326,791
10,000-25,000.....	60	853,355	101	1,457,330	184	2,132,872	117	1,606,206	18	246,690	29	514,302	23	322,027
25,000-50,000.....	26	885,757	36	1,336,135	36	880,045	34	1,090,357	3	39,000	8	282,500	4	178,500
50,000-100,000.....	11	592,022	31	1,929,450	22	1,479,650	11	795,200	2	111,300	4	329,000	2	170,000
Over 100,000.....	14	4,319,720	52	19,193,986	28	2,900,163	8	895,000	.....	.....	1	10,000	5	656,400
<b>STATES</b>														
Alabama.....	1	30,000	16	42,690	6	44,100	1	1,000	1	1,000	2	520	.....	.....
Arizona.....	4	50,500	5	40,500	1	11,500	4	25,300	4	25,300	18	15,879	30	73,608
Arkansas.....	4	11,000	7	42,050	28	148,400	23	453,746	2	1,750	.....	.....	.....	.....
California.....	12	391,303	22	2,438,075	62	383,906	53	453,746	.....	.....	193	969,741	114	469,838
Colorado.....	5	688,987	13	47,795	16	156,912	16	156,912	.....	.....	9	58,710	19	25,897
Connecticut.....	2	96,360	2	7,250	5	36,200	1	25,000	13	84,750	1	175	.....	.....
Delaware.....	.....	.....	1	1,750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
District of Columbia.....	1	35,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Florida.....	4	298,000	12	278,800	3	18,600	72	328,735	18	11,479	2	6,000	8	22,900
Georgia.....	.....	.....	50	381,000	4	20,950	.....	.....	1	1,000	.....	.....	.....	.....
Idaho.....	3	25,200	4	95,500	10	38,800	10	38,800	.....	.....	3	850	1	1,600
Illinois.....	5	121,050	166	649,031	72	518,445	72	518,445	22	32,755	.....	.....	19	31,155
Indiana.....	11	242,677	39	1,398,565	72	173,460	72	173,460	2	150	.....	.....	.....	.....
Iowa.....	35	373,400	2	22,000	198	751,083	21	47,000	84	65,365	2	400	.....	.....
Kansas.....	.....	.....	10	116,400	166	429,903	4	65,500	24	22,820	2	3,100	32	48,135
Kentucky.....	6	161,730	3	15,860	25	185,865	18	76,825	.....	.....	.....	.....	.....	.....
Louisiana.....	.....	.....	10	136,500	36	127,062	7	57,660	1	250	.....	.....	.....	.....
Maine.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maryland.....	3	13,445	3	831,500	11	828,887	4	25,500	1	120	1	16	.....	.....
Massachusetts.....	.....	.....	1	22,000	14	199,650	9	268,770	27	200,360	4	14,725	.....	.....
Michigan.....	7	123,359	21	485,810	21	322,603	2	13,910	13	60,020	2	6,210	6	16,725
Minnesota.....	9	969,170	8	12,990	81	170,854	87	241,935	3	2,900	.....	.....	.....	.....
Mississippi.....	.....	.....	6	31,100	6	33,000	10	31,430	.....	.....	.....	.....	.....	5,500

Missouri.....	1	1,200	26	104,661	126	385,894	8	16,759	21	10,830	1	1,000	16	19,805
Montana.....	3	21,500	5	5,300	1	3,000			4	5,130	9	3,910	23	22,840
Nebraska.....	4	2,950	40	109,265	57	167,526	2	14,000	8	5,330	12	12,190	18	7,528
Nevada.....	2	1,250	1	225	2	1,250	5	129,700	1	150	14	90,499	9	19,590
New Hampshire.....	3	2,270	3	2,270	3	2,270	10	69,819	25	143,390	1	8,150		
New Jersey.....	28	393,790	18	393,535	55	481,853	23	371,940	25	143,390	20	161,940	20	54,110
New Mexico.....	1	23,000	17	23,000	17	68,850	23	371,940						
New York.....	5	535,615	15	4,692,000	53	433,095	6	79,800	21	66,370	4	2,395		
North Carolina.....	14	167,415	13	324,240	41	472,115	19	194,042	39	29,954	11	2,000	2	1,370
North Dakota.....	3	6,100	11	79,600	11	79,600	1	3,000				8,500	43	41,190
Ohio.....	33	582,038	74	2,740,664	79	640,290	20	127,103	26	42,325				
Oklahoma.....	16	128,070	14	240,520	146	669,392	21	348,050	2	2,700			38	107,481
Oregon.....			6	11,230	21	66,400	30	107,400	3	600	5	14,900	5	7,900
Pennsylvania.....	10	1,461,356	36	1,444,405	69	595,930	24	218,200	7	12,100	4	1,400	1	400
Rhode Island.....	2	359,300	2	359,300	2	19,450			2	800			2	3,700
South Carolina.....			6	15,400	25	152,450	11	101,000	1	2,700	1	1,300	29	26,730
South Dakota.....	2	12,900	3	62,750	40	120,750	3	17,800						
Tennessee.....	1	5,900	11	155,150	22	333,140	8	51,230	1	500	96	549,365	166	1,323,090
Texas.....	1	6,000	43	1,496,890	106	1,203,990	130	1,451,955	6	5,130	4	3,386	3	1,200
Utah.....	1	9,400	1	9,400	7	62,190	12	91,108						
Vermont.....														
Virginia.....	1	5,000	9	191,320	30	62,500	6	31,480	1	300	1	100		
Washington.....			6	36,970	5	30,980	43	150,565	1	300	18	18,795	4	4,122
West Virginia.....	5	15,875	1	14,000	5	38,000						1,164		
Wisconsin.....	15	298,220	46	1,036,700	96	288,345	60	261,775	8	12,395	8	5,685	5	4,215
Wyoming.....	2	18,300			4	31,300			2	500	4	3,450	13	23,313
MAJOR DRAINAGE BASINS														
Northeast.....	5	156,975	10	428,950	65	652,980	13	339,750	55	334,100	10	16,461	1	400
North Atlantic.....	41	2,317,591	65	7,175,780	148	1,893,675	37	347,999	37	172,490	5	10,050	1	900
South Atlantic.....	20	530,415	36	717,940	142	1,084,455	117	708,977	61	44,513	5	8,120	14	31,360
Tennessee River.....	7	75,150	18	278,135	6	278,135	6	36,330					1	
Ohio River.....	40	891,122	96	2,022,540	177	1,136,890	62	415,062	28	34,865	9	2,164	1	900
Lake Erie.....	14	105,723	40	1,997,534	25	109,015	7	37,708	7	12,320				
Upper Mississippi.....	44	1,350,870	119	6,048,770	468	1,735,286	178	807,207	88	32,327	13	9,085	45	66,315
Western Great Lakes.....	22	339,029	48	1,472,220	61	429,623	27	171,905	16	64,875	3	6,310	3	2,550
Missouri River.....	17	641,950	66	316,236	305	809,200	28	235,123	69	58,443	35	23,850	131	133,774
Southwest-Lower Mississippi.....	22	246,197	33	568,520	348	1,431,001	86	794,792	21	19,425	27	107,995	99	220,568
Colorado River.....	5	54,860	4	255,215	9	53,290	11	132,300	27	101,724	42	101,724	42	88,732
Western Gulf.....	2	29,000	42	1,101,030	100	1,101,030	134	1,617,945	5	4,730	94	658,875	158	1,319,460
Pacific Northwest.....	8	48,875	15	79,850	29	120,080	88	338,065	4	4,900	27	34,245	13	16,035
California.....	11	389,700	22	2,438,075	59	371,109	52	445,110			169	902,155	93	393,723
Great Basin.....	14	18,000			10	77,247	14	105,644			39	80,271	29	87,615
Total.....	255	7,320,307	603	25,038,570	1,964	11,333,016	860	6,534,917	398	855,238	461	1,966,305	631	2,362,842

Table 9. Summary of chlorination, grease and grit removal, and sludge processing by population groups, States and drainage basins

	Plants with chlorination		Plants with grease removal		Plants with grit removal		Septic tanks (number of plants)	Inboff tanks (number of plants)	Stage digestion (number of plants)	Separate digestion (number of plants)	Sludge beds (number of plants)	Lagoons (Number of plants)	Mechanical methods (number of plants)	miscellaneous (number of plants)	None or no organized method (number of plants)
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served									
POPULATION SIZE GROUPS															
Under 500.....	146	80,515			15	10,485	261	327	2	103	374	4		10	424
500-1,000.....	246	182,320	3	2,430	74	56,855	289	648	5	272	940	13	2	18	357
1,000-5,000.....	921	2,177,417	20	56,323	555	1,402,394	490	1,432	46	1,270	2,609	41	17	52	778
5,000-10,000.....	340	2,365,174	17	119,840	314	2,345,284	52	200	57	1,517	716	17	25	22	103
10,000-25,000.....	292	4,082,876	22	333,290	296	4,111,507	20	92	83	372	459	34	46	28	63
25,000-50,000.....	127	3,991,809	15	539,495	133	4,262,292	3	22	44	113	123	23	39	30	19
50,000-100,000.....	54	3,865,995	12	635,170	76	5,172,972		16	12	58	59	10	23	18	13
Over 100,000.....	90	21,589,139	12	4,990,501	113	34,352,608	2	22	23	85	62	23	45	51	24
STATES															
Alabama.....	18	118,740			12	317,525	54	30	1	35	58	1			61
Arizona.....	7	290,000			10	326,632	18	17	5	22	32			2	50
Arkansas.....	14	91,850			14	112,570	13	32	6	66	99			1	19
California.....	140	6,021,330	11	350,638	35	4,973,640	78	102	26	214	283	6	7	20	150
Colorado.....	11	657,720			20	768,094	24	27	3	38	67	2		4	37
Connecticut.....	33	718,630			29	1,054,660	18	6	4	17	30	3	11	7	23
Delaware.....	7	19,520			1	150,000	1	3		5	6				3
District of Columbia.....	1	1,240,000	1	1,240,000	1	1,240,000				1					
Florida.....	129	1,018,015	1	600	59	606,570	47	31	7	92	109	1	4	40	59
Georgia.....	12	422,500	3	18,900	43	490,300	36	61	4	60	121				42
Idaho.....	23	105,000			11	62,600	25	6	5	14	21	1		7	30
Illinois.....	44	361,631	3	55,220	131	3,465,560	15	166	28	158	304	25	12	5	43
Indiana.....	60	1,348,732			77	1,813,057	7	36	6	88	100	21	8	16	12
Iowa.....	8	78,367	7	296,770	70	642,726	86	143	8	95	289	15	1	1	27
Kansas.....	1	45,000	2	69,900	18	479,800	4	172	32	41	227	11	11	3	11
Kentucky.....	40	234,235	1	8,000	30	345,570	11	33	6	30	71		2	2	11
Louisiana.....	39	275,542			16	177,500	9	42	3	19	55	2		1	14
Maine.....	2	1,460			1	2,000	13	3			3				17
Maryland.....	33	170,643	2	41,400	7	941,900	5	24	3	15	38		4	1	10
Massachusetts.....	26	1,264,920	5	791,630	27	1,425,510	9	17	9	8	41		2	2	24
Michigan.....	78	2,950,972	1	80,000	40	2,955,810	34	23	7	56	81	4	11	9	47
Minnesota.....	164	1,332,802	1	10,000	32	1,095,746	3	132	11	102	247	3	8	4	19
Mississippi.....	15	52,200					38	21		13	29				50

Missouri.....	11	38,100	2	79,490	32	241,175	93	4	85	167	2	5	16	57
Montana.....	6	27,690			5	52,550	34	7	7	28				54
Nebraska.....	2	2,300			3	90,000	20	1	66	121			4	39
Nevada.....	6	129,925			6	92,300	10	5	7	15			1	15
New Hampshire.....	8	27,750			4	37,400	6	7	2	10				15
New Jersey.....	176	1,952,281			48	2,891,603	26	54	111	159		21	5	41
New Mexico.....	3	12,100	1	23,000	15	335,340	13	3	26	61				8
New York.....	183	5,333,895	4	780,300	120	7,976,571	43	8	103	211	11	14	14	67
North Carolina.....	44	522,406	3	97,825	87	695,147	66	9	61	199		2		78
North Dakota.....	38	975,325	33	2,409,416	103	4,075,996	22	44	36	36		1	1	79
Ohio.....	13	720,020			41	1,552,262	23	11	169	209	13	33	11	14
Oklahoma.....	84	347,730			39	646,200	17	8	76	87				36
Oregon.....	146	1,395,230	3	105,300	51	3,053,855	25	100	93	195	4	9	6	27
Pennsylvania.....	11	95,010			9	476,710	4		8	5		5		85
Rhode Island.....	10	90,250			33	243,900	56	67	93	93				5
South Carolina.....	7	48,275	1	5,000	7	133,800	2	2	15	81	13	1		74
South Dakota.....	36	491,690			6	322,315	1	34	36	72				15
Tennessee.....	146	2,303,125	3	24,050	145	3,269,150	37	499	189	530	15	5	7	119
Texas.....	21	163,013	1	32,000	17	130,323	26	9	17	22				36
Vermont.....	2	3,400			1	8,100			2	1	1			6
Virginia.....	71	720,895	1	13,000	15	650,450	14		45	70	3		2	19
Washington.....	123	633,890	1	15,000	49	442,945	31	25	68	94		6	3	53
West Virginia.....	99	126,745			4	97,800	11	1	3	11		2	1	16
Wisconsin.....	99	797,470	2	3,400	45	1,608,365	12	40	264	299	8	12	23	14
Wyoming.....	2	18,800			3	51,800	11		6	11	1		1	27
MAJOR DRAINAGE BASINS														
Northeast.....	188	4,075,120	11	1,647,930	145	5,133,056	36	116	100	237	13	26	19	110
North Atlantic.....	441	8,900,839	6	1,374,900	142	1,312,683	62	185	14	422	8	43	24	151
Northeast.....	254	2,260,641	8	167,325	231	3,416,592	265	336	22	599	2	7	40	329
Tennessee River.....	204	3,408,585			11	322,200	16	30	30	62		1		22
Ohio River.....	23	967,620	23	967,620	182	3,155,822	63	245	255	466	26	31	24	80
Lake Erie.....	52	1,938,166	17	1,474,706	59	2,668,631	7	29	70	87	6	13	3	10
Upper Mississippi.....	253	1,940,515	11	314,300	242	3,361,329	102	409	40	959	45	28	27	126
Western Great Lakes.....	148	3,841,602	3	192,000	148	3,841,602	60	10	507	209	9	20	22	60
Missouri River.....	90	773,822	3	75,000	70	1,978,253	130	390	157	572	24	4	17	258
Southwest-Lower Mississippi.....	94	772,842	2	79,390	109	1,598,271	91	413	247	636	9	3	10	147
Colorado.....	18	380,030			20	434,442	48	31	41	67	2		4	84
Western Gulf.....	137	2,194,405	4	47,050	141	3,368,790	34	354	104	500		4		84
Pacific Northwest.....	230	1,124,910	1	15,000	100	1,153,745	75	44	36	201	15	10	10	112
California.....	135	5,997,833	11	350,638	34	4,970,640	68	93	26	261	5	7	17	135
Great Basin.....	27	199,305	1	32,000	19	163,908	33	22	33	51	1		3	52
Total.....	2,216	57,835,235	101	6,677,039	1,581	51,714,397	1,120	2,759	2,790	5,342	167	197	226	1,781

## II. ANALYSIS AND INTERPRETATION

### General

In 1957, 11,131 communities in the United States had sewer systems serving 98.4 million persons. This was slightly more than 57 percent of the total estimated population of the country in that year. These sewer systems served communities having a census population of 102 million, of whom 96.4 percent were connected to the sewer systems.

Of the 98.4 million population sewered, 22.3 percent discharged raw sewage and 77.7 percent treated sewage. If minor treatment—less than sedimentation—is not considered as treatment, sewage from 75.8 percent of the population connected to sewers is treated.

The 76.4 million persons served by treatment resided in 8,066 separate communities and were served by 7,518 treatment plants. The majority, 61.8 percent, of these plants furnished secondary treatment, and served 56.7 percent of the population served by treatment. Secondary treatment plants served 44 percent of the total population connected to sewers.

#### *States*

The percent of census population in sewered communities connected to the sewer systems varied considerably among the States, ranging from 74.5 percent in New Hampshire to over 140 percent in Nevada. The percentages by States for this item are given in table 10, together with percentages of connected population from which sewage is discharged raw or treated for both 1945 and 1957. The percent of census population sewered exceeds 100 percent in some cases because 1957 estimated population served data are compared to 1950 census population data.

In 16 States the population served by treatment exceeds 90 percent of the total sewered population. This is twice as many States as reported such a high percentage in 1945. As noted above, treatment is provided for 77.7 percent of the population served by sewers. This nationwide figure is exceeded in 23 States. In 1945 the population served by treatment was less than 20 percent of the sewered population in 9 States, while in 1957 this had been reduced to 2 States, Maine and New Hampshire.

#### *Geographical Areas*

Census Bureau geographical area groupings have been used in table 11 for the purpose of analyzing general sewage works data. The States included in each group are listed in the footnotes of this table. The grouping of data on a geographic basis such as is used here is not entirely pertinent to evaluation of sewage works. However, the groups are

standard ones used for a variety of governmental statistics, and their use here permits comparisons to be made with data in other fields that might be pertinent to an analysis of a special problem. In addition, the States in each group afford some homogeneity of economic, industrial, and social patterns.

Table 10. *Percent of census population in sewerred communities connected to sewers and raw and treated discharge—by States*

State	Population connected in sewerred communities, percent of census population	Percent of connected population sewage discharged			
		Raw		Treated	
		1945	1957	1945	1957
Alabama.....	78.7	52.0	47.9	48.0	52.1
Arizona.....	129.6	9.1	4.4	90.9	95.6
Arkansas.....	82.0	47.3	40.6	52.7	59.4
California.....	107.6	26.5	2.3	73.5	97.7
Colorado.....	114.6	14.4	5.9	85.6	94.1
Connecticut.....	88.0	23.9	7.8	76.1	92.2
Delaware.....	95.6	81.4	8.0	18.6	92.0
District of Columbia.....	(1)				
Florida.....	91.0	53.5	25.9	46.5	74.1
Georgia.....	83.7	40.3	39.5	59.7	60.5
Idaho.....	89.5	76.2	53.2	23.8	46.8
Illinois.....	96.5	6.7	5.0	93.3	95.0
Indiana.....	98.0	29.3	16.4	70.7	83.6
Iowa.....	85.9	31.2	28.3	68.8	71.7
Kansas.....	101.8	30.0	20.3	70.0	79.7
Kentucky.....	99.6	73.1	12.6	26.9	87.4
Louisiana.....	88.6	79.5	73.0	20.5	27.0
Maine.....	84.9	97.7	89.1	2.3	10.9
Maryland.....	(1)	8.3	4.0	91.7	96.0
Massachusetts.....	87.5	38.3	29.2	61.7	70.8
Michigan.....	97.8	18.7	14.3	81.3	85.7
Minnesota.....	83.2	12.9	7.7	87.1	92.3
Mississippi.....	84.3	74.8	67.3	25.2	32.7
Missouri.....	84.9	81.0	73.0	19.0	27.0
Montana.....	98.7	71.2	55.0	28.8	45.0
Nebraska.....	91.2	53.8	51.8	46.2	48.2
Nevada.....	141.8	4.0	5.1	96.0	94.9
New Hampshire.....	74.5	89.9	81.2	10.1	18.8
New Jersey.....	98.0	21.8	2.3	78.2	97.7
New Mexico.....	134.7	0.5	0.2	99.5	99.8
New York.....	99.6	37.6	29.3	62.4	70.7
North Carolina.....	99.6	35.5	30.1	64.5	69.9
North Dakota.....	93.6	16.7	20.3	83.3	79.7
Ohio.....	102.4	33.0	17.8	67.0	82.2
Oklahoma.....	89.8	21.7	4.4	78.3	95.6
Oregon.....	98.7	81.6	8.1	18.4	91.9
Pennsylvania.....	89.6	72.9	42.0	27.1	58.0
Rhode Island.....	84.0	18.1	0.7	81.9	99.3
South Carolina.....	89.7	41.9	41.2	58.1	58.8
South Dakota.....	90.8	18.1	15.3	81.9	84.7
Tennessee.....	99.8	82.4	54.2	17.6	45.8
Texas.....	96.9	8.6	2.0	92.0	98.0
Utah.....	102.7	86.8	59.5	13.2	40.5
Vermont.....	84.3	94.8	78.1	5.2	21.9
Virginia.....	98.8	72.1	34.3	27.9	65.7
Washington.....	102.7	79.3	57.6	20.7	42.4
West Virginia.....	86.4	89.6	75.3	10.4	24.7
Wisconsin.....	97.2	8.7	8.9	91.3	96.1
Wyoming.....	104.1	63.9	36.0	36.1	64.0
Total.....	96.4	37.3	22.3	62.7	77.7

<sup>1</sup> These percentages are not shown, since they are unrealistic due to the effect of the Washington Suburban Sanitary Commission discharging to the District of Columbia plant.



On this basis the variations in percentage data are materially reduced. Only in the Pacific area does the percent of sewered population connected to treatment facilities exceed 90 percent. The corresponding low percentage is for the East South Central group where 55.7 percent is served by treatment. This latter figure compares with only 31.3 percent treated in 1945 in the same group of States, indicating substantial progress.

Table 11. *Population served by sewers and sewage treatment—by geographical areas*

Geographical area	1950 census population of sewered communities	Estimated population connected to sewers	Percent of census population connected to sewers	Percent of national total population connected to sewers	Percent of connected population—sewage discharged	
					Raw	Treated
New England <sup>1</sup> .....	7,457,052	6,438,212	86.3	6.5	30.7	69.3
Middle Atlantic <sup>2</sup> .....	24,880,112	23,888,535	96.0	24.3	28.6	71.4
South Atlantic <sup>3</sup> .....	10,073,854	9,541,001	94.7	9.7	27.6	72.4
East North Central <sup>4</sup> .....	22,644,009	22,298,605	98.5	22.7	11.3	88.7
East South Central <sup>5</sup> .....	4,540,363	4,136,957	91.1	4.2	44.3	55.7
West North Central <sup>6</sup> .....	8,548,368	7,556,663	88.4	7.7	36.9	63.1
West South Central <sup>7</sup> .....	8,696,785	8,097,385	93.2	8.2	16.5	83.5
Mountain <sup>8</sup> .....	3,112,949	3,530,294	113.4	3.6	22.2	77.8
Pacific <sup>9</sup> .....	12,104,220	12,873,744	106.4	13.1	9.3	90.7
Total.....	102,047,712	98,361,396	96.4	100.0	22.3	77.7

<sup>1</sup> Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

<sup>2</sup> New York, New Jersey, Pennsylvania.

<sup>3</sup> Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.

<sup>4</sup> Ohio, Indiana, Illinois, Michigan, Wisconsin.

<sup>5</sup> Kentucky, Tennessee, Alabama, Mississippi.

<sup>6</sup> Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

<sup>7</sup> Arkansas, Louisiana, Oklahoma, Texas.

<sup>8</sup> Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.

<sup>9</sup> Washington, Oregon, California.

## Drainage Basins

Analytical data for the major drainage basins used in this report are presented in table 12. The North Atlantic basin has 10.9 percent of the total sewered communities in the United States, but these contain 22.0 percent of the population. The Upper Mississippi basin has the largest percentage of communities, 13.9 percent. In the Western Gulf basin sewage from almost 98 percent of the sewered population is treated while in the Great Basin only 49.8 percent of the population is so served.

While the above data types are interesting in developing a national picture of pollution conditions, the administrative arrangements necessary to solve the remaining raw sewage discharge problem are pointed out in the community analysis portion of table 12. In the Ohio River Basin over 58 percent of the population is served by treatment—lower than the national average of 77.7 percent, but a reasonable figure when considered in light of what existed in this basin 10 to 12 years ago. Yet, 52 percent of the communities in the Ohio basin discharge all of their sewage raw. The administrative complexities of dealing with this substantial percentage of communities in the solution of their sewage problems are obviously greater in proportion than in some other drainage

areas. While enforcement of and compliance with pollution-control measures is along State lines, the development of the basin concept over the last 20 years makes comparisons of this type necessary for proper evaluation of program operations.

Table 12. *Percentage data for sewer systems and raw and treated discharge—by drainage basins*

Major drainage basins	Percent of U. S. total communities	Percent of census population connected to sewers	Percent of national total population connected to sewers	Percent of connected population—sewage discharged		Percent of total communities discharging			
				Raw	Treated	Raw	Treated	Both raw and treated	
Northeast.....	8.0	90.7	9.9	27.3	72.7	49.4	48.0	2.6	
North Atlantic.....	10.9	97.6	22.0	21.5	78.5	28.5	70.8	.7	
Southeast.....	10.0	88.1	6.6	35.9	64.1	27.3	71.2	1.5	
Tennessee River.....	1.3	108.5	1.0	46.2	53.8	43.4	53.1	3.5	
Ohio River.....	12.2	95.6	9.7	41.7	58.3	52.0	46.8	1.2	
Lake Erie.....	1.9	103.2	3.0	5.0	95.0	30.0	68.2	1.8	
Upper Mississippi.....	13.9	91.8	12.1	14.7	85.3	17.5	82.3	.2	
Western Great Lakes.....	5.1	97.8	6.4	10.9	89.1	34.0	65.7	.3	
Missouri River.....	10.1	96.1	4.1	38.0	62.0	23.8	75.6	.6	
Southwest-Lower Mississippi.....	8.4	91.9	5.3	34.8	65.2	17.8	82.1	.1	
Colorado River.....	1.7	127.6	.8	6.7	93.3	15.4	84.1	.5	
Western Gulf.....	5.6	98.1	5.1	2.2	97.8	2.7	97.3	.....	
Pacific Northwest.....	4.2	100.6	2.8	42.5	57.5	28.2	69.8	2.0	
California.....	5.5	107.5	10.5	2.0	98.0	5.6	94.1	.3	
Great Basin.....	1.2	105.2	.7	50.2	49.8	25.9	73.4	.7	
Total.....	100.0	96.4	100.0	22.3	77.7	.....	.....	.....	

### Population Groups

Table 13 presents data showing the percentage distribution among the various groups for sewerred communities, census population of these communities, connected population, populations discharging raw and treated sewage, and number of treatment plants.

Disposal facilities of communities in group 8 or of sanitary districts classed in this group serve 53.2 percent of the total United States sewerred population, approximately the same percentage as in 1945. However, this same group accounts for only 1.0 percent of the sewerred communities in the United States, and for 2.2 percent of the total treatment plants.

In general, the percentage data developed in this table closely parallel similar data for 1945. The major difference is in the percent of total sewerred communities for those of less than 500 population. This increased to 11.3 percent in 1957 from 8.8 percent in 1945.

The percent of census population connected to sewers within each group, together with the percent of population discharging raw and treated sewage for both 1945 and 1957, is given in table 14.

For 1957, there are no discernible patterns for percent of census population served by sewers, whereas, in 1945, there were increasing percentages with increasing community size except for group 1.

In 1945, three of the groups bettered the national percentage of treated discharge, while in 1957 only group 8 exceeds the national average. However, all groups have experienced substantial increases in the percent of sewered population served by treatment plants. The largest such increase was in group 7, where the percentage increased from 54.3 in 1945 to 74.6 percent in 1957.

Table 13. *Percentage data for sewer systems and raw and treated discharge—by population groups*

Population size groups	Percent of total number of sewered communities	Percent of 1950 census population of sewered communities	Percent of total population connected				Percent of total number of treatment plants
			To sewer systems	To raw discharge or treatment facilities <sup>1</sup>	To raw sewage discharge facilities	To sewage treatment facilities	
Under 500.....	11.3	0.4	0.4	0.4	0.4	0.4	10.7
500-1,000.....	17.6	1.4	1.3	1.2	1.6	1.1	17.6
1,000-5,000.....	46.8	12.7	10.9	9.7	12.7	8.9	46.1
5,000-10,000.....	11.4	8.6	8.6	7.4	7.9	7.2	11.5
10,000-25,000.....	8.0	13.2	13.9	11.3	12.4	11.0	7.9
25,000-50,000.....	2.7	10.0	10.5	8.2	9.6	7.8	2.7
50,000-100,000.....	1.2	9.2	9.7	8.6	9.8	8.3	1.3
Over 100,000.....	1.0	44.5	44.7	53.2	45.6	55.3	2.2
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0

<sup>1</sup> Percent of total connected population discharging through sewer outfall facilities of the population group.

Table 14. *Percent of census population connected to sewers and population discharging raw or treated sewage within population groups*

Population size groups	Percent of census population in sewered communities connected to sewers		Percent of connected population discharging			
			Raw		Treated	
	1945	1957	1945	1957	1945	1957
Under 500.....	22.7	112.1	35.7	25.5	64.3	74.5
500-1,000.....	77.1	90.1	135.5	29.2	164.3	70.8
1,000-5,000.....	77.6	82.5	39.1	29.1	60.8	70.9
5,000-10,000.....	83.4	96.5	42.0	23.8	58.0	76.2
10,000-25,000.....	88.0	101.3	43.7	24.4	56.3	75.6
25,000-50,000.....	95.7	100.7	41.8	26.0	58.2	74.0
50,000-100,000.....	96.7	101.4	45.7	25.4	54.3	74.6
Over 100,000.....	95.3	96.9	33.0	19.1	67.0	80.9
Total.....	91.1	96.4	37.3	22.3	62.7	77.7

<sup>1</sup> 0.2 percent discharging through semipublic facilities not included.

<sup>2</sup> 0.1 percent discharging through semipublic facilities not included.

### *Comparison with Prior Data*

Selected comparative data from earlier statistical summaries are presented in table 15. The 1957 Inventory shows an increase of 2,214 community sewer systems and almost 24 million persons served over the 1945 data. These represent increases of 24.8 and 31.6 percent, respectively. The increase in population served by treatment facilities was 63.1 percent during this same period, while there was a decrease of 21.4 percent in the number of persons connected to raw sewage discharges.

Table 15. Comparative data for 1940-57 for sewage disposal systems

	1940	1945	1948	1949	1957
Number of sewer communities...	8,516	8,917	(*)	(*)	11,131
Census population.....	175,728,000	182,012,692	(*)	(*)	182,047,712
Estimated population connected...	70,506,000	74,740,887	76,680,685	78,850,870	98,361,396
Percent of census population connected.....	93.1	91.1	.....	.....	96.4
Raw discharge:					
Number of communities.....	3,597	3,610	3,800	3,718	3,165
Estimated population served.....	29,889,000	27,867,783	27,982,490	28,067,350	21,917,665
Percent of total sewer population.....	42.4	37.3	36.5	35.6	22.3
Treated discharge:					
Number of Communities.....	5,085	5,480	(*)	(*)	8,066
Estimated population served.....	40,617,000	46,865,114	46,690,195	50,783,520	76,443,731
Percent of total sewer population.....	57.6	62.7	63.5	64.4	77.7

\* Data not available.

1 1940 census data.

2 1950 census data.

3 Includes 166 communities discharging both raw and treated sewage.

4 Includes 173 communities discharging both raw and treated sewage.

5 Includes communities where only part of sewage is discharged untreated.

6 Includes 100 communities discharging both raw and treated sewage.

7 Includes 7,990 population discharging through semi-public facilities and not included in discharge data.

Since 1940 the percentage of total sewer population connected to raw discharge facilities has declined almost one-half. While this indicates substantial progress, the decline in total population in this category for 1940-1957 has only been 26.7 percent. The obvious conclusion is that treatment has been keeping abreast of population increases, but that it has not made substantial reductions in the population discharging raw sewage during the last 17 years. Tentative estimates based on these data indicate there has even been a small increase in population equivalents from community systems discharged to the streams of the Nation.

Table 16 presents data for 1940, 1945, and 1957 relating to population served and population discharged to the stream based on assigned percentage reductions for the various degrees of treatment. These reductions were derived from population equivalent data reported in the 1957 Inventory for approximately 56 percent of the sewer population. Table 16 is based on "population" only, since comparable population equivalent data are not available for years earlier than 1957.

Table 16. Sewage discharge to watercourses in 1940, 1945, and 1957

Treatment	Assigned percent reduction	Estimated population discharged—1000's		
		1940	1945	1957
None.....	0.0	29,889	27,868	21,918
Minor.....	0	3,288	4,270	1,860
Primary.....	31.3	10,396	11,798	17,633
Intermediate.....	45.5	2,201	2,051	3,047
Secondary.....	82.5	3,178	3,790	7,582
Total.....	.....	48,952	49,777	52,040

This analysis indicates that an increase of 4.5 percent in the total population discharged to streams occurred in the period 1945-1957, and that an increase of 6.3 percent occurred during the 1940-1957 period.

Even with the remarkable increases in population served by sewage treatment since 1945, the fact that sewage from over 52,000,000 persons is still discharged to the Nation's streams is cause for reflection as to the efficacy of current pollution-abatement programs.

Preliminary population equivalent data extrapolated for the entire sewered population indicate that community sewer systems receive in excess of 140 million population equivalents. These same preliminary adjustments further indicate that approximately 75 million population equivalents are discharged to streams. This entire group of data is being subject to special study which will be reported in a later paper.

### *Development of Community Sewer Systems*

During the years since World War II, there has been a marked increase in the urban population with the concomitant development of the so-called metropolitan area. Data presented by Hyde (4) indicate that in the urban population a lag of 5 to 8 million persons not served by community sewer systems has existed since 1860. In 1945 (3) the lag was approximately 7 million persons. The data in this summary indicate a lag of only 3.7 million persons. While the census population used for comparison is mainly for 1950, the application of a ratio of 1957 to 1950 census data for the entire United States would increase the lagged population to only slightly over 4 million persons. In addition, the percent of total United States population sewered in 1957 increased to 57.5 percent from approximately 53 percent for 1940 through 1949. Table 17 presents information showing the development of community facilities.

These two facts tend to indicate that the new urban population is being connected to sewer systems as it develops, and that some headway has been made in reducing the population resident in urban areas but not served by the community sewer systems.

Over 2,200 communities have installed sewer systems since 1945, an increase in number of almost 25 percent. The corresponding increase in sewered population is almost 32 percent. The increase from 1945 to 1957 in the census population of sewered communities is slightly less than 25 percent. Since the sewered population increase is substantially greater than the corresponding increase in census population of sewered communities, further credence is given to the statement that there is a trend toward reduction of the population in urban communities not connected to sewer systems.

As would be surmised, the preponderance of sewered communities is in the smaller population size groups. Almost 76 percent of sewered communities had less than 5,000 population, and 95.1 percent had less than 25,000. Contrasted to this, the large populations served are in the larger population size groups. The communities of over 100,000 popu-

lation comprise only 1.0 percent of the total communities yet they furnish 44.7 percent of the population connected to sewers, and serve over 53 percent of this population through their raw discharge or treatment facilities. These percentages are slightly less than those in 1945. These data are shown in table 13, and accumulated percent data for 1945 and 1957 are shown in table 18.

Table 17. *Development of sewer systems in the United States*

Year	Total United States population—millions	Sewage facility development	
		Numbered of sewer communities	Population served by sewers—millions
1860 <sup>1</sup>	31.4	10	1.0
1870	38.6	100	4.5
1880	50.2	400	9.5
1890	62.9	450	16.1
1900	76.0	950	24.5
1910	92.0	1,600	34.5
1920	105.7	3,000	47.5
1930	122.8	5,100	61.5
1935	132.0	6,800	69.5
1940 <sup>2</sup>	132.7	8,516	70.5
1945 <sup>3</sup>	139.6	8,917	74.7
1948 <sup>4</sup>	<sup>5</sup> 144.6	( <sup>6</sup> )	76.7
1949 <sup>4</sup>	<sup>5</sup> 149.2	( <sup>6</sup> )	78.9
1957	<sup>5</sup> 171.2	11,131	98.4

<sup>1</sup> Data for 1860 to 1935, inclusive, from Hyde, C. G.: *Modern Sewage Disposal*. Federation of Sewage Works Associations, 1938, pp. 1-14.

<sup>2</sup> Data for 1940 from (2). "Number of communities corrected from 8,518."

<sup>3</sup> Data for 1945 from (3).

<sup>4</sup> Data for 1948 and 1949 from unpublished U. S. Public Health Service data.

<sup>5</sup> July 1 data, estimated by Census Bureau, Current Population Reports, Series P-25.

<sup>6</sup> Not available.

Table 18. *Percent of total sewer communities and connected population by population groups*

Population size groups	Communities sewerd (accumulated percent of total)		Estimated connected population (accumulated percent of total)	
	1945	1957	1945	1957
Under 500	8.8	11.3	0.3	0.4
500-1,000	27.6	28.9	1.6	1.7
1,000-5,000	76.3	75.7	11.9	12.6
5,000-10,000	87.6	87.1	19.7	21.2
10,000-25,000	95.3	95.1	31.9	35.1
25,000-50,000	97.7	97.8	41.6	45.6
50,000-100,000	98.9	99.0	51.2	55.3
Over 100,000	100.0	100.0	100.0	100.0

The data in table 18 present some interesting items. Other than in the smallest two groups the accumulated percentages of total number of sewer communities were practically the same in 1957 as in 1945, while some rather significant divergences are apparent in the accumulated percentages of estimated populations connected to sewer systems. While the increase in number of sewer communities appears to have been distributed among the several groups proportionate to conditions existing

in 1945, the connected population increase has been proportionately larger in the communities between 5,000 and 50,000.

In the 1945 summary (3) it was pointed out that while the largest community group (over 100,000 population) was the dominant one with respect to population served, the practice in the communities of this group was, in almost every case, a special problem, and, that this does not represent sewage works practice in the United States. This statement is just as pertinent when the 1957 data are considered, and may be even more so when some of the above facts are considered.

### *Sanitary Districts and Communities Serving Others*

As reported in the 1957 Inventory, over 20.1 million persons in the United States were served by raw discharge or treatment facilities of other communities or sanitary districts. This is a 65-percent increase over similar data in 1945. With respect to special districts which discharge sewage from the majority of the population included in the 20.1 million figure, it should be noted that only those districts are included which were reported as such by the States as separate inventory listings. There are undoubtedly other such districts, many of whose boundaries are conterminous with the community they serve, whose existence as such has not been reported, and hence are not reported in this summary.

While some of the increase in population served by other communities and/or special districts may be ascribed to better reporting, the conclusion is obvious that this method of sewage disposal is being resorted to much more frequently. In table 19 the percentage interchange of population among communities for 1945 and 1957 are shown. There has been a substantial increase in population served by other communities or sanitary districts for the communities in the smaller groups, and a concomitant rise in the population received by facilities of the largest group for disposal. It may well be argued that this is a gratifying development, since larger plants are normally better operated and designed more rationally. However, the situation still remains that most of the smaller communities are so situated that they cannot avail themselves of such favorable circumstances as connection to larger systems. Their problems are no less real, however, and invite the concern of official agencies.

### *Type of Sewers*

Data from over 10,500 communities reported in the inventory indicate that 82.1 percent are served by separate sewer systems, 13.8 percent by combined sewer systems, and the remainder have both separate and combined sewers. Table 20 shows the percentage of each type sewers within each population group. During the period 1945 to 1957 there was an actual decrease in the number of communities reporting combined sewer systems, with practically all of the increase being reported for communities having separate sewers. It appears that the trend is toward separate systems, exclusively.

Table 19. *Percent of sewered population served by or serving others—by population groups*

	Year	Population size groups							
		Less than 500	500-1,000	1,000-5,000	5,000-10,000	10,000-25,000	25,000-50,000	50,000-100,000	Over 100,000
Percent of sewered population served by raw discharge or treatment facilities of others.....	{1957 1945	12.8 7.6	6.9 3.7	11.9 6.2	16.3 10.8	22.9 14.0	27.7 20.9	25.1 17.6	20.4 19.2
Percent of population served from other communities.....	{1957 1945	0.2 2.5	0.6 0.3	1.9 1.9	2.8 2.5	5.1 2.7	7.6 6.3	15.2 11.2	33.0 26.4

Table 20. *Percent of each type of sewer within population groups*

Population size groups	Percent <sup>1</sup> of communities with—		
	Separate sewers	Combined sewers	Both separate and combined sewers
Under 500.....	92.8	6.6	0.6
500-1,000.....	86.3	12.4	1.3
1,000-5,000.....	83.9	13.2	2.9
5,000-10,000.....	77.2	16.3	6.5
10,000-25,000.....	73.1	17.1	9.8
25,000-50,000.....	60.9	24.0	15.1
50,000-100,000.....	50.4	34.6	15.0
Over 100,000.....	45.6	33.3	21.1
Total.....	82.1	13.8	4.1

<sup>1</sup> Percent of known cases.

## TREATMENT

More than 76 million persons in the United States were served by 7,518 treatment plants in 1957. Table 1 shows the number of plants and population served for each degree of treatment, together with corresponding percentages.

Secondary treatment serves the largest number of persons and accounts for almost 57 percent of all plants. Since 1945 there has been a 100-percent increase in the number of persons served by secondary treatment and a two-thirds increase in the number of secondary plants. These percentage-change data, together with other available comparative data for the years 1940 to 1957, are shown in table 21.

Significantly, there have been decreases since 1949 in the numbers of plants for all degrees of treatment other than secondary, and substantial decreases in the number of persons served by treatment of less than sedimentation for both the 1949-1957 and 1945-1957 periods.

The percentage distributions within population groups and drainage basins for number of plants and population served for the various degrees of treatment are presented in tables 22 and 23, respectively.

With respect to population groups, and with the exception of intermediate treatment, no significant patterns are discernible. Intermediate



treatment frequency increases as does the size of community as to both numbers of plants and populations served.

On the other hand, there are quite significant differences in practice among the drainage basins. In the Western Gulf basin almost 97 percent of the population connected to treatment is served by secondary plants, compared with less than 23 percent so served in the Northeast basin. The Missouri River basin has the highest percentage of population served by intermediate treatment, while the Pacific Northwest basin reports the greatest percentage served by primary treatment. There appears to be some correlation between the degree of treatment and the degree of industrialization with possible correlation, also, with population density or degree of urbanization. Such an analysis, however, has not been made for this report, and any definite conclusions await further study.

Table 21. Sewage treatment data—1940 to 1957

Degree of treatment	NUMBER OF PLANTS					Percent change <sup>3</sup>	
	1940	1945	1948	1949	1957	1945-57	1949-57
Minor.....	49	60	51	54	41	(31.7)	(24.1)
Primary.....	2,899	2,829	2,984	3,019	2,730	(3.5)	(9.6)
Intermediate.....	2,630	98	106	107	100	2.0	(6.5)
Secondary.....		2,799	2,917	3,050	4,647	66.0	52.4
Total.....	15,580	5,786	6,058	6,230	7,518	29.9	20.7

ESTIMATED POPULATION SERVED—1000's							
Minor.....	3,288	4,270	4,019	3,851	1,860	(56.4)	(51.7)
Primary.....	15,133	17,173	18,393	17,218	25,667	49.5	49.1
Intermediate.....	22,171	3,763	3,595	3,625	5,591	48.6	54.2
Secondary.....		21,659	22,691	26,090	43,326	100.0	66.1
Total.....	40,617	46,865	48,698	50,784	76,444	63.1	50.5

<sup>1</sup> Includes 12 plants—unknown treatment.

<sup>2</sup> Includes 25,000—unknown treatment.

<sup>3</sup> ( ) denotes decrease.

### Primary Treatment

In 1957 there were 2,730 primary treatment plants in the United States serving almost 26 million persons. Table 2 shows the number of plants and estimated population served for the several types of plants, together with corresponding percentages.

Imhoff tank plants are the most numerous type, comprising almost 40 percent of all primary plants. In 1945, Imhoff tank and septic tank plants together comprised 83.5 percent of the total primary plants, and served 36.0 percent of the population. In 1957 these percentages had declined to 68.3 and 16.8 percent, respectively. While the number of Imhoff plants increased from 1945 to 1957, there was a 31.2 percent decrease in the population served. The corresponding decrease for septic tank plants was 25.5 percent.

Table 22. Number of plants and population served by degree of treatment—percent of total within each population size group

Population size groups	Total		Minor		Primary		Intermediate		Secondary	
	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served
Under 500.....	100.0	100.0	0.2	0.1	39.2	36.0	.....	.....	60.6	63.9
500-1,000.....	100.0	100.0	.3	.3	41.6	39.9	0.3	0.3	57.8	59.3
1,000-5,000.....	100.0	100.0	.4	.4	37.7	32.2	.0	.8	61.3	66.6
5,000-10,000.....	100.0	100.0	.7	.5	23.0	29.0	2.4	3.8	61.2	66.7
10,000-25,000.....	100.0	100.0	1.0	9.1	26.2	23.7	3.4	3.9	69.4	63.3
25,000-50,000.....	100.0	100.0	.5	.5	35.7	36.3	8.5	9.4	55.3	53.8
50,000-100,000.....	100.0	100.0	6.1	7.2	25.2	24.2	6.1	5.5	52.6	63.1
Over 100,000.....	100.0	100.0	3.1	1.3	57.3	57.2	7.3	9.7	51.8	51.8
Total.....	100.0	100.0	0.6	2.4	36.3	33.6	1.3	7.3	61.8	56.7

Table 23. Number of plants and population served by degree of treatment—percent of total within each major drainage basin

Major drainage basins	Total		Minor		Primary		Intermediate		Secondary	
	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served	Number of plants	Estimated population served
Northeast.....	100.0	100.0	3.1	15.8	59.2	59.3	1.2	2.2	36.5	22.7
North Atlantic.....	100.0	100.0	2.1	3.2	41.4	32.5	2.2	12.3	54.3	52.0
Southeast.....	100.0	100.0	.9	1.4	60.5	36.1	.4	6.5	32.2	56.0
Tennessee River.....	100.0	100.0			62.4	36.4			37.6	63.6
Ohio River.....	100.0	100.0			35.7	25.1	3.4	11.0	60.9	63.9
Lake Erie.....	100.0	100.0								
Upper Mississippi.....	100.0	100.0			28.2	21.5	5.5	2.2	66.3	76.3
Western Great Lakes.....	100.0	100.0	.4		24.7	9.6	.6	8.6	74.7	81.8
Missouri River.....	100.0	100.0	.1	.1	43.8	55.1	6.0	8.6	49.8	31.2
Southwest-Lower Mississippi.....	100.0	100.0			28.0	13.6	1.0	24.2	70.9	62.1
Colorado River.....	100.0	100.0			30.0	19.0	.7	2.5	69.3	78.5
Western Gulf.....	100.0	100.0			40.9	13.8	2.6	6.8	56.5	79.4
Pacific Northwest.....	100.0	100.0			16.1	3.1			83.9	96.9
California.....	100.0	100.0	.9	1.1	47.4	61.9	.9	1.3	50.8	35.7
Great Basin.....	100.0	100.0	.7	1.2	27.9	58.4	1.0	2.7	70.4	37.7
	100.0	100.0			26.0	14.5	1.9	2.1	72.1	83.4
Total.....	100.0	100.0	0.6	2.4	36.3	33.6	1.3	7.3	61.8	56.7

The increase in mechanically cleaned tank primary plants was substantial. They comprise almost one-fourth of all primary plants, but serve 72.7 percent of the overall population. From 1945 to 1957 they increased over 84 percent in numbers and 95.1 percent in population served.

Table 24 shows the percent of plants of various types as well as connected population within each population group. Table 25 reports the same data by drainage basins. In general, septic tank and Imhoff plants predominate in the smaller groups, with mechanically cleaned tank plants coming into major use in the communities of over 5,000 population. Considerable variation in practice exists among the various basins. In the Pacific Northwest basin over 93 percent of the population served by primary treatment is connected to plants with mechanically cleaned tanks. The corresponding figure is only 4.4 percent in the Western Gulf basin.

### *Intermediate and Secondary Treatment*

Almost 49 million persons in the United States are served by 4,747 intermediate and secondary treatment plants. The activated sludge process is used in 589 plants serving 24.8 million persons—over 57 percent of the total population served by secondary treatment. Trickling filters, both standard and high rate, total 2,682 plants and serve over 15 million persons. Intermediate treatment is defined as chemical treatment with sedimentation in the absence of any secondary process. There are 100 such plants serving 5.6 million persons.

Percentage distribution within population groups and drainage basins for the various major secondary treatment processes are shown in tables 26 and 27. Activated sludge plants are the predominant type in cities of over 25,000 population. Standard rate trickling filters predominate in the communities under this size. The use of oxidation ponds is a major item in group 1—less than 500 population.

The distribution of plant types by drainage basins shows considerable variation in practice. In the Lake Erie basin, almost 55 percent of the plants are of the activated sludge type while in the Colorado River basin only 5.2 percent are reported. In this latter basin, 43.7 percent of the plants are oxidation ponds. Sand filters continue to be a major plant type only in the Northeast basin. High-rate trickling filters comprise a majority of 52.7 percent of the plants in the Pacific Northwest basin.

As explained in the introductory section, two types of data are presented concerning intermediate and secondary treatment. First is additive data where plants incorporating two or more processes have been arbitrarily assigned to a type of plant. In former summaries (2), (3) data were arranged on a unit process basis. This type of arrangement has been continued to present comparable data.

Comparative data are presented in table 28 for the years 1940, 1945, and 1957. The population served by the activated sludge process

Table 24. Primary treatment—percent of plants and population served within population groups

Population size groups	Total		Septic tanks		Imhoff tanks		Mechanically cleaned tanks		Plain hopper bottom tanks		Tank—no detail		Others and unknown	
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served
Under 500.....	100.0	100.0	48.3	40.1	42.6	50.4	4.7	6.0	2.8	2.3	0.6	0.9	1.0	0.3
500-1,000.....	100.0	100.0	34.0	29.5	48.4	48.9	9.8	13.3	4.4	4.5	.9	1.1	2.5	2.7
1,000-5,000.....	100.0	100.0	32.2	24.6	44.0	39.1	19.2	28.0	2.7	2.7	2.1	2.6	2.7	3.0
5,000-10,000.....	100.0	100.0	15.7	9.3	24.4	15.7	50.0	65.3	1.6	1.5	2.5	3.2	5.8	5.0
10,000-25,000.....	100.0	100.0	9.6	5.0	14.1	13.3	67.9	74.1	2.6	2.6	2.6	2.9	3.2	2.1
25,000-50,000.....	100.0	100.0	2.8	2.5	14.1	10.8	70.4	77.0	1.3	4.9	4.2	3.5	7.1	4.4
50,000-100,000.....	100.0	100.0	3.2	Neg.	24.0	26.6	64.0	65.8	4.0	7.1	3.0	3.5	1.6	2.1
Over 100,000.....	100.0	100.0	3.2	Neg.	17.8	7.1	69.3	81.0	3.2	7.1	4.9	4.6	1.6	2.1
Total.....	100.0	100.0	28.6	3.3	39.7	13.0	24.0	72.7	2.9	5.2	2.0	4.0	2.8	1.3

Table 25. Primary treatment—percent of types of plants and population served within drainage basins

Major drainage basins	Total		Septic tanks		Imhoff tanks		Mechanically cleaned tanks		Plain hopper bottom tanks		Tank—no detail		Others and unknown	
	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served	Num-ber of plants	Estimated population served
Northeast.....	100.0	100.0	25.9	2.7	29.3	16.7	31.9	74.7	5.6	1.8	1.7	2.3	5.6	1.3
North Atlantic.....	100.0	100.0	17.6	3.2	35.3	12.3	26.4	59.3	4.6	21.8	7.3	1.6	8.8	1.8
Southeast.....	100.0	100.0	38.5	16.5	41.9	17.5	16.3	58.7	1.7	1.7	1.2	3.3	1.4	3.2
Tennessee River.....	100.0	100.0	22.6	8.3	47.2	30.7	15.1	48.3	1.9	1.9	13.2	12.1	1.4	2.1
Ohio River.....	100.0	100.0	21.5	4.1	43.6	19.8	23.8	73.8	.....	.....	1.4	2	4.7	.....
Lake Erie.....	100.0	100.0	19.4	6	54.8	75.2	22.6	23.9	.....	.....	3.2	3	.....	.....
Upper Mississippi.....	100.0	100.0	18.2	4.6	42.0	11.6	35.3	82.4	4.2	1.1	.....	.....	3	3
Western Great Lakes.....	100.0	100.0	18.3	1.1	28.3	11.4	47.3	84.8	3.8	1.2	1.5	1.7	3	3
Missouri River.....	100.0	100.0	30.5	23.1	56.4	34.1	8.6	38.9	1.2	1.4	1.8	5	2.5	2.0
Southwest-Lower Mississippi.....	100.0	100.0	31.3	12.2	41.2	20.5	15.8	61.2	6.7	2.9	3.3	2.5	1.7	7
Colorado River.....	100.0	100.0	52.4	32.7	28.6	31.5	9.5	25.6	7.9	4.4	.....	.....	1.6	5.8
Western Gulf.....	100.0	100.0	17.8	10.1	74.3	73.3	2.0	4.4	1.0	2.9	1.0	8	3.9	8.5
Pacific Northwest.....	100.0	100.0	35.9	3.4	19.2	3.2	43.6	93.2	1.3	2	.....	.....	.....	.....
California.....	100.0	100.0	34.8	5	11.3	3.3	44.3	87.4	.....	.....	4.4	11.3	5.2	5
Great Basin.....	100.0	100.0	59.2	49.8	25.9	22.6	14.9	27.6	.....	.....	.....	.....	.....	.....
Total.....	100.0	100.0	22.6	3.3	39.7	13.0	24.0	72.7	2.9	5.2	2.0	4.0	2.8	1.3

Table 26. Secondary treatment—percent of types of plants and population served within population groups

Population size groups	Total		Activated sludge		Trickling filter standard rate		Trickling filter high rate		Intermittent sand filter		Application to land		Lagoons		Others and unknown	
	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served
Under 500.....	100.0	100.0	5.3	5.6	26.7	26.3	8.6	22.6	13.2	11.5	15.5	10.2	20.6	19.7	5.1	4.1
500-1,000.....	100.0	100.0	6.9	7.3	41.5	41.9	13.9	15.7	13.2	11.2	7.3	6.2	13.2	14.2	3.4	2.8
1,000-5,000.....	100.0	100.0	10.0	10.6	43.0	41.8	17.1	20.6	7.2	5.6	7.3	7.8	9.3	7.7	5.5	5.9
5,000-10,000.....	100.0	100.0	13.4	15.2	45.4	43.2	24.4	27.5	4.2	3.3	4.5	4.0	3.9	3.6	4.2	3.2
10,000-25,000.....	100.0	100.0	23.0	25.2	40.0	34.9	26.1	28.7	4.1	4.3	1.7	2.4	1.0	.9	4.1	3.6
25,000-50,000.....	100.0	100.0	36.4	39.7	23.2	22.7	27.3	28.5	1.8	1.2	3.6	5.5	1.8	2.4	4.1	3.6
50,000-100,000.....	100.0	100.0	48.5	46.6	29.0	29.7	14.5	15.5	3.2	2.8	3.2	3.6	2.4	2.4	1.9	Neg.
Over 100,000.....	100.0	100.0	61.2	87.6	23.2	8.4	8.2	3.8	.....	.....	.....	.....	.....	.....	1.6	1.8
Total.....	100.0	100.0	12.7	57.1	40.2	21.6	17.5	13.8	8.5	1.9	7.3	2.3	9.2	1.8	4.6	1.5

Table 27. Secondary treatment—percent of plants and population served within drainage basins

Major drainage basins	Total		Activated sludge		Trickling filter standard rate		Trickling filter high rate		Intermittent sand filter		Application to land		Lagoons		Others and unknown	
	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served	Num-ber of plants	Esti-mated popu-lation served
Northeast.....	100.0	100.0	7.0	30.4	30.8	27.5	7.7	19.7	37.8	20.6	2.8	Neg.	0.7	Neg.	4.2	1.8
North Atlantic.....	100.0	100.0	18.0	81.2	30.9	11.4	10.2	2.9	10.8	1.9	1.5	0.1	2.3	Neg.	18.4	2.5
Southeast.....	100.0	100.0	10.2	31.9	37.6	40.7	30.2	25.0	16.7	1.9	1.4	.5	2.5	Neg.	1.4	.5
Tennessee River.....	100.0	100.0	25.8	19.2	56.2	78.6	12.5	1.7	9.4	1.0	2.5	.1	3.1	Neg.	2.5	.6
Ohio River.....	100.0	100.0	25.7	55.9	45.2	31.0	10.4	11.4	7.4	1.0	2.5	.1	.3	Neg.	2.5	.6
Lake Erie.....	100.0	100.0	54.8	94.0	27.4	3.9	8.2	1.5	8.2	5	1.2	.5	4.4	Neg.	1.4	1
Upper Mississippi.....	100.0	100.0	13.4	72.5	29.0	18.1	18.7	7.8	10.2	1.0	1.2	.5	1.7	Neg.	1.7	Neg.
Western Great Lakes.....	100.0	100.0	31.2	46.0	36.9	19.8	18.1	8.5	10.1	2.3	2.0	.3	7	Neg.	1.0	1
Missouri River.....	100.0	100.0	19.7	90.5	40.0	51.2	4.4	15.1	11.2	3.8	3.7	1.2	20.0	8.1	1.0	2
Southwest-Lower Mississippi.....	100.0	100.0	5.2	18.5	61.0	42.9	13.8	27.3	3.8	4.7	3.8	2.9	9.9	4.5	1.5	3.2
Colorado River.....	100.0	100.0	3.5	46.3	10.3	9.7	12.6	24.1	4.6	4.6	25.3	2.8	43.7	12.5	19.2	4.7
Western Gulf.....	100.0	100.0	8.0	29.3	17.6	22.2	23.9	33.3	4.1	1.1	13.1	6.9	17.3	3.5	3.5	4.7
Pacific Northwest.....	100.0	100.0	9.0	14.0	16.8	20.9	52.7	59.2	2.4	.2	12.5	3.8	6.6	1.9	1.9	1.4
California.....	100.0	100.0	6.6	61.9	18.3	8.8	17.2	11.5	2.4	.2	39.3	11.6	15.5	5.0	3.1	1.4
Great Basin.....	100.0	100.0	.....	.....	13.3	27.8	18.7	38.0	.....	.....	45.3	21.3	20.0	8.2	2.7	4.7
Total.....	100.0	100.0	12.7	57.1	40.2	21.6	17.5	13.8	8.5	1.9	7.3	2.3	9.2	1.8	4.6	1.5



Table 28. *Intermediate and secondary treatment processes—comparative data for 1940, 1945 and 1957*

Type of treatment	Number of plants			Estimated population served millions		
	1940	1945	1957	1940	1945	1957
Chemical treatment.....	185	197	255	4.0	5.3	7.3
Activated sludge.....	302	324	603	10.5	11.6	25.0
Trickling filter standard rate.....	1,486	1,459	1,964	8.4	8.8	11.3
Trickling filter high rate.....		122	860		.7	6.5
Intermittent sand filter.....	432	448	398	.9	1.0	.9
Application to land.....	304	422	461	.9	1.3	2.0
Lagoons.....	(*)	45	631	(*)	.2	2.4

\*Not available.

Table 29. *Plants providing chlorination and grit removal by population groups*

Population size groups	Percent of total plants providing--			
	Chlorination		Grit removal	
	1945	1957	1945	1957
Under 500.....	15.1	18.1	2.3	1.9
500-1,000.....	15.4	18.6	3.9	8.6
1,000-5,000.....	19.7	26.6	9.5	16.0
5,000-10,000.....	29.8	39.4	22.9	36.4
10,000-25,000.....	36.5	49.1	32.5	49.7
25,000-50,000.....	33.3	63.8	36.9	66.8
50,000-100,000.....	32.4	54.5	52.1	76.8
Over 100,000.....	37.7	54.9	52.5	72.0
Total.....	21.8	29.5	13.2	21.0

increased from 11.6 to 25.0 million during the 1945-57 period. This represents the largest increase. The greatest percentage increase during this period was for oxidation ponds. The number of plants increased from 45 to 631, and the population served increased from 0.2 to 2.4 million.

### *Sludge Digestion*

Units for the digestion of sewage sludge were classified under four headings: Septic tanks, Imhoff tanks, separate, and stage. Separate sludge digestion units increased over 100 percent from 1945, to a total of 2,790 plants. Imhoff tanks were used for sludge digestion in 2,759 plants. Separate digestion units comprised a majority of digestion facilities in plants located in communities of over 5,000 population. Imhoff tanks and septic tanks predominate in the smaller plants.

### *Sludge Dewatering*

Sludge drying beds are reported in use at 5,342 plants—71.1 percent of all treatment plants. Over 1,700 plants are listed as not having sludge dewatering or other organized method of drying in use. The majority of these plants are small septic tank or Imhoff tank plants, where sludge is drawn infrequently. It is probable that some of the plants reported in

this category may have drying units that have not been reported in the inventory.

### *Chlorination*

Almost 38 million persons are served by 2,216 plants incorporating chlorination facilities. This comprises 49.5 percent of the people served by treatment and 29.5 percent of the treatment plants. In 1945, comparable percentages were 34.2 and 21.8, respectively. The increase in population served since 1945 is 136.0 percent and in the number of plants is 75.6 percent.

As in 1945, New York and New Jersey have the largest number of plants equipped for chlorination—183 and 176 respectively. California and New York have the largest populations served by chlorination.

The provision of chlorination facilities increases as the size of community increases. Percentage data for 1945 and 1957 are shown in table 29. In group 1, only 18.1 percent of the plants have chlorination, while in group 8 almost 55 percent of the plants provide chlorination.

### *Grit Removal*

The removal of grit from sewage is practiced at 1,581 treatment plants serving almost 52 million persons. While this represents only 21.0 percent of the treatment plants, they serve almost 68 percent of the population connected to treatment. Percentage increases from 1945 to 1957 were 106.7 and 86.1 percent for treatment plants so equipped and population served, respectively.

Comparative percentage data for 1945 and 1957 are shown in table 29 for the various population groups. Rather striking changes have occurred since 1945 in the plants serving communities of over 1,000 population. The percent of total plants having grit removal devices in these groups has increased substantially.

### *Grease Removal*

Grease removal as an integral unit in the treatment process is reported to be in use at 101 plants in the United States, serving 6.7 million persons. This report indicates fewer persons served in 1957 than in 1945. It is considered that this item may be substantially underreported due to a confusion in the use of coding symbols in the inventory.

### **Acknowledgement**

The data on which the inventory is based were furnished by the various State water pollution control agencies through the Regional Offices of the Public Health Service. Grateful acknowledgment is due the personnel of the State agencies for their cooperation in preparing the base data. In many instances, personnel of the Regional Offices assisted the official agencies, and appreciation is expressed for their very material efforts.

Since this activity has been conducted by the Public Health Service, the data preparation has been performed by Arthur D. Smart. His

valuable and loyal efforts over a period of almost 20 years have been a considerable factor in the success of the inventory.

NOTE.—The data presented in this report constitute only a small portion of the material prepared from the inventory. The population group data are a primary classification and were prepared as a single entity. The State data were synthesized from the data by population groups within each State, and the major drainage basin data were synthesized from the individual subbasin data.

These tables are available in the Washington headquarters office of the Public Health Service. Excerpted data will be made available to interested parties. In addition, a variety of special tabulations can be prepared on request.

Any correspondence relating to special tabulations or to the availability of unpublished data should be directed to: Water Supply and Water Pollution Control Program, Public Health Service, U. S. Department of Health, Education, and Welfare, Washington, 25, D. C.

## References:

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